

SPECIFICATIONS

CHARLESTON FIRE DEPARTMENT FIRE STATION #18

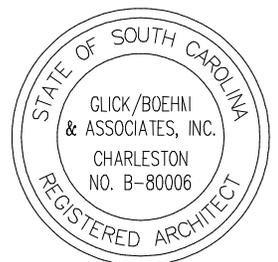
235 Seven Farms Drive
Charleston, South Carolina 29492

For The Owner:

City of Charleston

GBA PROJECT N^o.: 2326

DATE: May 20, 2025



ARCHITECTURE / PLANNING / INTERIOR DESIGN

GLICK/BOEHM & ASSOCIATES, INC.

493 King Street, Suite 100

Charleston, South Carolina 29403

Telephone: 843.577.6377

Internet: www.gbaarchitecture.com

00 00 01

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PROJECT DIRECTORY

PROJECT: **CFD Fire Station #18**
235 Seven Farms Drive
Charleston, SC 29492

OWNER: **City of Charleston**

ARCHITECT: **Glick/Boehm & Associates, Inc.**
493 King Street, Suite 100
Charleston, SC 29403
843-577-6377

STRUCTURAL CONSULTANT: **ADC Engineering**
1226 Yeamans Hall Road
Hanahan, SC 29410
843-566-0161

MECHANICAL/ELECTRICAL/
PLUMBING CONSULTANT: **DWG Consulting Engineers, Inc.**
1009 Anna Knapp Blvd., Suite 202
Mount Pleasant, SC 29464
843-849-1141

END OF PROJECT DIRECTORY

00 00 03

**City of Charleston
Invitation for Construction Bids**

PROJECT: PRJ_2504 - Fire Station #18 Renovations

BID SECURITY REQUIRED? YES
PERFORMANCE BOND REQUIRED? YES
PAYMENT BOND REQUIRED? YES

CONSTRUCTION COST RANGE \$ 1,000,000 - 1,200,000

DESCRIPTION OF PROJECT: The scope of work is interior renovations and modifications to the existing 11,363SF building as shown in the drawings. To include structural, mechanical, electrical and plumbing systems as well as new finishes, fixtures and casework.

A/E NAME: Glick Boehm & Associates
A/E CONTACT: Shawn Mellin, AIA
A/E EMAIL: Mellin@gba-arch.com
ADDRESS: 493 King Street, Suite 100 Charleston, SC 29403
PHONE: 843-566-0161

PLANS ON FILE AT: aeplanroom.com

PLANS MAY BE OBTAINED FROM: A+E Digital, 517 King Street, Charleston, SC 29403

PRE-BID CONFERENCE? YES MANDATORY ATTENDANCE? YES

PRE-BID MEETING DATE/TIME: January 28, 2026 at 10:00 am
PRE-BID LOCATION: 235 Seven Farms Drive, Charleston, SC 29492

BID OPENING DATE/TIME: Thursday February 19th at 2:30 pm.
BID DELIVERY ADDRESS: 823 Meeting Street, Charleston SC 29403
2ND FLOOR, CAPITAL PROJECTS RECEPTION DESK

PROJECT MANAGER: Gable D. Stubbs, AIA
PROJECT MANAGER EMAIL: stubbsg@charleston-sc.gov
PROJECT MANAGER PHONE: (843) 608-5066

00 00 04

**City of Charleston
Instructions to Bidders**

1. RECEIPT AND OPENING OF BIDS

The City of Charleston (the "Owner"), will receive bids for the above Project at the City of Charleston, Department of Parks, until Thursday February 19th at 2:30 PM local time, where they shall be publicly opened and read aloud. The Owner may consider non-responsive any bid not prepared and submitted in accordance with these instructions and may waive any informality or reject any and all bids. Information not requested that is written on or attached to the Bid Form that could be considered a qualification of the Bid, may be cause for rejection of the Bid. The City shall be the sole judge as to whether Bids submitted meet all requirements contained in this solicitation. This solicitation does not commit the City of Charleston to award a Contract, to pay any costs incurred in the preparation of Bids submitted, or to procure or contract for the services. Any bid may be withdrawn prior to the above scheduled time or authorized postponement. Any bid received after the time and date specified shall not be considered. No Bidder may withdraw a bid within 60 days after the date of the bid opening.

2. CANCELLATION OF INVITATION FOR CONSTRUCTION BIDS

At any time prior to the issuance of the Notice to Proceed for this Project, the Contract may be cancelled for the convenience of the Owner.

3. PREPARATION OF BID

Bids must be submitted in writing on the attached City of Charleston Bid Form in whole dollar amounts. All blank spaces for bid prices must be filled in, in ink or typewritten, and the form must be fully completed and executed when submitted. Failure to provide all requested information as part of the submitted bid may be justification to deem the bid non-responsive, resulting in the rejection of the bid. Each bid must be submitted in a sealed envelope bearing on the outside the name and address of the Bidder and the name of the Project for which the bid is submitted and the Contractor's license number. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed to the City of Charleston, City of Charleston, Department of Parks, 823 Meeting Street, Charleston, SC 29403.

4. PRE-BID CONFERENCE

A mandatory PRE-BID Conference will be held on January 28, 2026 at 10:00 am. If mandatory, only those prospective Bidders that are represented and are listed on the sign-in sheet will be allowed to submit bids.

5. SUBCONTRACTS

The Bidder is specifically advised that any person, firm or other party to whom it proposes to award a subcontract under this Contract must be acceptable to the Owner. In the event a subcontractor is found to be unacceptable by the Owner, the Owner may require the Bidder to substitute the unacceptable subcontractor or reject the bid. The Bidder must perform a minimum of 25% of the work with its own forces.

6. QUALIFICATIONS OF BIDDER

The Owner may make such investigations as it deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner in a timely manner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner of the Bidder's qualifications to perform the work.

The Bidder must demonstrate verifiable experience in the following areas:

- Successful completion of at least three (3) renovation projects of comparable scope within the City of Charleston.
- Successful completion of at least three (3) completed fire station projects of similar scope and complexity.
- Documented experience working on projects involving Municipal Governments and/or Fire Departments.

Bidders shall provide a Statement of Qualifications highlighting relevant projects and experience that meet the criteria above and a narrative describing why the firm is well-suited for this project, including a project approach/methodology, and a staffing plan supported by resumes demonstrating relevant experience.

7. BID SECURITY

If required, each bid must be accompanied by a Bid Security in the amount of not less than 5% of the Base Bid in the form of a certified cashiers check or a Bid Bond, made payable to the Owner and issued by a surety licensed to do business in the state of South Carolina. The Bid Bond must be accompanied by a certified and current Power of Attorney by the Attorney-in-Fact. The Owner shall have the right to retain the Bid Security of any or all Bidders until such time as one of the three conditions listed below have been met:

1. The Construction Contract has been executed and both Performance and Payment Bonds have been furnished, if required.
2. The specified time has elapsed so that bids may be withdrawn.
3. The Owner has rejected all bids.

8. FAILURE TO ENTER INTO CONTRACT

Failure of the Bidder to execute and deliver the Contract within ten (10) days after bid opening or failure to provide Performance and Payment Bonds and Certificate of Insurance within ten (10) days of receipt of a Notice of Award from the Owner, shall entitle the Owner to consider the Bidder non-responsive and to declare the Bid Security forfeited.

9. DATE OF COMMENCEMENT, COMPLETION AND LIQUIDATED DAMAGES

Bidder must agree to commence work as specified in a Notice to Proceed from the Owner and to fully complete the Base Bid and any awarded Bid Alternates within **180 days** calendar days after the Date of Commencement. Bidder must agree also to pay as liquidated damages the sum of **\$500.00 per day** for each calendar day thereafter that the Project fails to reach Substantial Completion within the time allowed.

10. ADDENDA AND INTERPRETATIONS

No oral interpretation of the meaning of the plans, specifications or other pre-bid documents will be made. Requests for clarification should be made in writing to the A/E or Project Manager identified in the Invitation for Construction Bids and to be given consideration must be received at least ten (10) days prior to the date fixed for the opening of bids. Any interpretations, corrections or changes will be issued in the form of written addenda and will be transmitted to all who are known to have received a complete set of bidding documents by telephone, fax or other appropriate means with immediate follow-up with written addenda. Should the original Bid Date be postponed, the new Bid Date shall be no earlier than the fifth (5th) calendar day after the date of issuance of the addendum postponing the original Bid Date. Failure of any Bidder to receive any such addendum or interpretation shall not relieve such Bidder from any obligation under its bid as submitted. All addenda so issued shall become part of the Contract documents.

11. SUBSTITUTIONS

- A. The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.
- B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- C. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.
- D. No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

12. LAWS AND REGULATIONS

All applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

13. INTENT TO AWARD/EVALUATION OF BID ALTERNATES

It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder. When bidding documents include Bid Alternates, the Owner shall have the right to award the Contract to the apparent low bidder based on ANY COMBINATION of the BASE BID plus Bid Alternates or with no Bid Alternates, unless otherwise specifically provided in the Bid Documents. The Owner reserves the right to apply these Alternate prices in any combination or order for the overall benefit of the Project as defined by the Owner. All requested Alternates must be bid. The failure of the Bidder to indicate a price for a BID ALTERNATE shall render the Bid non-

responsive. A BID ALTERNATE shall be bid by indicating either a dollar amount or the words "No Change", "Zero", or "0.00". A typed or printed "No Bid", or words of similar meaning, shall

render the Bid non-responsive. Bidder must indicate whether the amount of the BID ALTERNATE is an "ADD" to or a "DEDUCT" from the amount of the base bid. The Bid may be determined non-responsive for failure of the Bidder to indicate the appropriate "ADD" or "DEDUCT" for each BID ALTERNATE.

14. OBLIGATION OF BIDDER

At the time of the opening of bids, each Bidder will be presumed to have inspected the site and the conditions relating to construction of the Project, and to have read and become thoroughly familiar with the plans and Contract documents, including all addenda. The failure or omission of any Bidder to visit the site or to examine any form, instrument or document shall in no way relieve any Bidder from any obligation with respect to his bid.

15. LICENSES AND PERMITS

The successful Bidder shall obtain a City of Charleston Business License prior to beginning the work of the Contract. Bidder must also be licensed under the laws of the State of South Carolina and City of Charleston for the specific category of work to be performed. **No building permit fee is required. Permit shall be issued without charge to the successful responsible and responsive low bidder.**

16. PERFORMANCE AND PAYMENT BONDS

The successful Bidder, if required by the Owner, will provide Performance and Payment Bonds, each in the amount equal to 100% of the Contract Award, as a condition of execution of the Contract. Failure to supply such bonds as required by the Contract Documents shall result in forfeiture of the Bid Bond.

17. DRUG FREE WORKPLACE

All Bidders must certify that they will provide a "Drug-Free Workplace" as that term is defined in Section 44-107-30 of the SC Code of Laws and shall comply with the requirements set forth in Title 44, Chapter 107.

END OF INSTRUCTIONS TO BIDDERS

00 00 05

City of Charleston Bid Form

BID SUBMITTED BY: Name:
Address:

FOR PROJECT: PRJ_2504 - Fire Station #18 Renovations
(Number) (Name)

OFFER

1. In response to the *Invitation for Construction Bids*, and in compliance with the *Instructions to Bidders* for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the City of Charleston ("Owner") in the form included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.
2. Bidder has submitted Bid Security as follows in the amount and form requested by the Bidding Documents:
 Bid Bond with Power of Attorney Cashier's Check
(Bidder check one)
3. Bidder, by submitting this Bid, affirms that it has carefully examined the Bidding Documents and the other related information and data identified in the Bidding Documents, has visited the actual location of the Work, has satisfied itself as to all conditions and understands that, in signing this Bid Form it waives all rights to plead any misunderstanding regarding same and agrees to be bound by the provisions of said Bidding Documents and all statements made therein.
4. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into its Bid:
ADDENDUM No.(s) _____
5. Bidder acknowledges that neither the Owner nor any of its 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 cancelled for any reason prior to the issuance of the Notice to Proceed.
6. By submitting this Bid, Bidder hereby agrees to all of the terms and conditions of the *Invitation for Construction Bids* and to all of the terms and conditions of the *Instructions to Bidders*. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of 60 days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner. Bidder understands that Bid Alternates that are not accepted in an initial award shall remain open for acceptance for the entire period set above and for such longer period as requested by Owner and agreed to by Bidder.
7. Bidder herewith submits its 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 and applicable taxes necessary to complete the construction work in accordance with the Bidding Documents:

7.1 BASE BID: \$ _____

Written: _____

7.2 ALTERNATE BID WORK (as indicated in the Bidding Documents and generally described as follows):
 (Bidder shall STRIKE THROUGH "ADD" or "DEDUCT" so as to clearly indicate the price adjustment offered for each alternate)

ALTERNATE NO. 1: _____ ADD/DEDUCT \$ _____

(to or from BASE BID)

ALTERNATE NO. 2: _____ ADD/DEDUCT \$ _____

(to or from BASE BID)

ALTERNATE NO. 3: _____ ADD/DEDUCT \$ _____

(to or from BASE BID)

7.3 UNIT PRICE WORK

Bidder offers for the Owner's consideration and use the following UNIT PRICES. The UNIT PRICES offered by Bidder indicate the amount to be added to or deducted from the Base Bid for each item-unit combination. UNIT PRICES include all costs to the Owner, including those for materials, labor, equipment, tools of trades and labor, fees, taxes, insurance, bonding, overhead, profit, etc. The Owner reserves the right to include or not to include any of the following UNIT PRICES in the Contract and to negotiate the UNIT PRICES with Bidder.

NO.	ITEM	ESTIMATED QUANTITY	UNIT PRICE
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

00 00 09

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned, _____
(Name of Principal)

AS PRINCIPAL, AND _____, as SURETY
(Name of Surety)

are held and firmly bound unto The City of Charleston hereinafter called the "Owner", in the penal sum of _____ Dollars, lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying bid, dated _____, 20_____, for Project Name: _____ and Project Number: _____.

Now, THEREFORE, if the Principal shall not withdraw said bid within the period specified therein after the opening of the same, or, if no period be specified, within sixty (60) days after the said opening, and shall within the period specified therefore, or, if no period be specified within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the Owner in accordance with the bid as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract; or in the event of the withdrawal of said bid within the period specified, or the failure to enter into such contract and give such bond within the time specified, if the Principal shall pay the Owner the difference between the amount specified in said bid and the amount for which the Owner may procure the required work or supplies or both, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

The Surety, for value received, hereby agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extensions of the time within which the Owner may accept such BID; and said Surety does hereby waive notice of any such extensions.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, 20_____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

(SEAL) _____
(Name of Principal)

By: _____

(SEAL) _____
(Name of Surety)

By: _____

Sealed and delivered in the presence of:

00 00 10

At the Contractor's option, this form may be substituted with a Power of Attorney form from the Contractor's Surety Company. The Contractor is cautioned that all pertinent information included on this form shall be incorporated in the executed and submitted security form.

CERTIFICATE OF GUARANTEE / BORROWER'S ATTORNEY

I, the undersigned, _____,
the duly authorized and acting legal representative of _____
_____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties' names thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

(Signature)

(Date)

00 00 11

At the Contractor's option, this form may be substituted with a Performance Bond and Power of Attorney form from the Contractor's Surety Company. The Contractor is cautioned that all pertinent information included on this form shall be incorporated in the executed and submitted security form.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that _____
(Name of Contractor)

at _____
(Address of Contractor)

a _____, hereinafter called "Principal",
(Corporation, Partnership or Individual)

and _____
(Name of Surety)

at _____, hereinafter called "Surety", are held
(Address of Surety)

and firmly bound unto the City of Charleston Department of Parks, 823 Meeting Street, Charleston, SC, 29403, hereinafter called "Owner", in the penal sum of :
_____ Dollars(\$_____)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____, 20__, a copy of which is hereto attached and made a part hereof for the construction of:

(Project #) (Project Name)

NOW, THEREFORE, is the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise it shall remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alterations or addition to the terms of the contract or to the work or to the specification.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each one of which shall be deemed an original, this the ____ day of _____, 20__ .

ATTEST:

(Principal) Secretary
(SEAL)

(Principal)
By: _____

(Witness as to Principal)

(Address)

(Surety)

ATTEST:

(Surety) Secretary
(SEAL)

By: _____
(Attorney -in-fact)

(Address)

(Address)

NOTE: Date of bond must not be prior to date of Contract.
If Contractor is Partnership, all partners should execute bond.

Important: Surety companies executing bonds must appear on the Treasury Department most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

00 00 12

At the Contractor's option, this form may be substituted with a Payment Bond and Power of Attorney form from the Contractor's Surety Company. The Contractor is cautioned that all pertinent information included on this form shall be incorporated in the executed and submitted security form.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

that _____ at _____
(Name of Contractor) (Address of Contractor)

a _____, hereinafter called "Principal", and
(Corporation, Partnership or Individual)

_____ at _____
(Name of Surety) (Address of Surety)

herinafter called "Surety", are held and firmly bound unto the City of Charleston Department of Parks, 823 Meeting Street, Charleston, SC, 29403, hereinafter called "Owner", in the penal sum of

_____ Dollars (\$_____)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____, 2002, a copy of which is hereto attached and made a part hereof for the construction of:

(Project Name)

NOW, THEREFORE, is the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alterations or addition to the terms of the contract or to the work or to the specification.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each one of which shall be deemed an original, this the ___ day of __, 20__.

ATTEST:

(Principal) Secretary

(Principal)

By: _____

(SEAL)

(Witness as to Principal)

(Address)

(Surety) Secretary

(Surety)

(SEAL)

(Address)

By: _____
(Attorney-in-Fact)

(Address)

NOTE: Date of bond must not be prior to date of Contract.
If Contractor is Partnership, all partners should execute bond.

Important: Surety companies executing bonds must appear on the Treasury Department most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

00 00 14

City of Charleston
CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT: PRJ 2504 Fire Station #18 Renovations
(Number) (Name)

This is Part Two of a two-part form. The Contractor Request for Certificate of Substantial Completion is to be completed by the Contractor and delivered to the A/E or design professional. The Certificate of Substantial Completion is to be completed by the A/E and submitted to the City for approval.

CERTIFICATION

I hereby certify that Substantial Completion has been accomplished in conformance with the requirements of the Contract. This certification declares that:

- A. The remaining work is not disruptive to the function of the facility occupants and is limited to items minor in nature and scope. *(Examples are minor repairs to finishes, electrical device cover plates, and hardware and window adjustments.)*
- B. The Contractor's Request for Certificate of Substantial Completion and all attachments thereto have been reviewed, and any exceptions are noted.
- C. The composite A/E's Punch List is attached, with the status of each item noted.
- D. All other requirements of the Contract related to Substantial Completion have been accomplished, including delivery of all operational and maintenance manuals, record drawings, maintenance training, warrantee certificates and start up activities.

DATE FOR SUBSTANTIAL COMPLETION:

(This is also the date for the commencement of warranties required by the Contract.)

(DATE)

SPECIAL CONDITIONS OR STIPULATIONS CONCERNING THE COMPLETION OF PUNCH LIST ITEMS OR EXPLANATIONS OF PARTIAL SUBSTANTIAL COMPLETION.

A/E's CERTIFICATE BY:

(Signature of A/E Representative)

(Print or Type Name of A/E Rep)

ITS: _____

(Date)

INSTRUCTIONS TO THE A/E:

Forward both the Contractors Request and this form with attachments to the City for review and approval.

CITY ACCEPTANCE:

(Signature of City Representative)

(Print or Type Name of City Rep)

ITS: _____

(Date)

00 00 15

City of Charleston
SUBSTANTIAL COMPLETION AGREEMENT

PROJECT: PRJ_2504 Fire Station #18 Renovations
(Number) (Name)

Instructions: The items checked below are required to be completed, operational and documented in order for the project to be declared Substantially Complete. If Partial Substantial Completion is anticipated the sequence and portions of the project shall be identified and the selected items below will be required for each partial substantial completion area.

ARTICLE 1 – CITY REQUIREMENTS

In addition to the requirements of the Construction Documents, a Substantial Completion requires the following certifications and documents to be fully completed, executed, approved and delivered attached to this form.

1. Approval by South Carolina Department of Health & Environmental Control for:
 - a. Potable water
 - b. Sewer and wastewater system
 - c. Air emissions
 - d. Food Service
 - e. Facility Licensing
 - f. Other (*list*): _____

2. Certification from the Site Civil Engineer and /or Landscape Architect of Record that:
 - a. Plantings and grassing have been inspected and are in accord with specifications and regulations.
 - b. Site drainage and storm water retention system have been inspected and are in accord with specifications and regulations.
 - c. Other (*list*): _____

3. Certification from the Mechanical Engineer of Record that:
 - a. Fire suppression system has been tested and is operational.
 - b. Condensate lines and drains are as designed and operational.
 - c. HVAC system has been tested and balanced.
 - d. Fuel gases system inspected and in accord with regulations.
 - e. Boiler systems tested and certified in accordance with regulations.
 - f. Plumbing systems are as designed and operational.
 - g. Laboratory/medical gas systems tested and operational.
 - h. Other (*list*): _____

4. Certification from the Electrical Engineer of Record that:
 - a. Electrical system has been tested and operates in accord with codes.
 - b. Fire alarm system has been tested and operates in accord with codes.
 - c. Smoke detection system has been tested and operates in accord with codes.
 - d. Smoke evacuation system has been tested and operates in accord with codes.
 - e. All lights and switches, receptacles are function as designed.
 - f. Emergency illumination is operational as designed.
 - g. Other (*list*): _____

5. Construction Inspection Services
- a. Copies of all inspection reports are provided and corrections are documented as satisfactory.
 - b. Building Official has provided Certificate of Occupancy or written approval of the project.
 - c. Other (*list*): _____
-
6. Letter or Certificate of Approval from the local Fire Official.
- a. Fire protection services can be provided.
 - b. Access for fire fighting equipment is acceptable.
 - c. Fire extinguishers and their locations are acceptable.
 - d. Exit paths are maintained clear and with little or no fire exposure.
 - e. Other (*list*): _____
-
7. Certification from Fire Marshal that:
- a. Sprinkler system test and inspection report is acceptable.
 - b. Stand pipes are satisfactorily installed and operational.
 - c. Range hood and fire suppression system is installed and operational.
 - d. Other (*list*): _____
-
8. Other: _____
-

ARTICLE 2 – A/E REQUIREMENTS

Substantial Completion requires the following certifications and documents are fully completed, executed, approved and delivered attached to this form. The Punch List of incomplete or unacceptable work may not include any fire and life safety items.

1. Contractor has furnished the final punch list as required by General Conditions
- a. Building egress and exit paths are clear of construction materials and equipment.
 - b. All building systems are functional and correctly operating.
 - c. Other (*list*): _____
-
2. Contractor has furnished the required Documents and Manuals:
- a. Field-record drawings with "as built" markings.
 - b. Building system operations and maintenance manuals.
 - c. Spare parts and extra materials stocks as per specifications.
 - d. Other (*list*): _____
-
3. Other: _____
-

ARTICLE 3 – CONTRACTOR'S REQUIREMENTS

In addition to the requirements of the Construction Documents, Substantial Completion requires the following certifications and documents are fully completed, executed, approved and delivered attached to this form.

1. City intends to occupy the facility as defined in the Contract and as follows:
 - a. When facility is finally complete (one date).
 - b. When identified portions of the facility are complete (multiple dates as attached).
 - c. In phases (as per City schedule attached).
 - d. Other (*list*): _____

2. Sub-contractors have furnished the required documents, training and manuals.
 - a. City facility personnel have been trained as per specifications.
 - b. Building system operations and maintenance manuals delivered to the Contractor.
 - c. Building keying is completed for delivery to City.
 - d. Other (*list*): _____

3. Consent of Surety to the:
 - a. Release of Retainage.
 - b. Final Payment.

4. Other:
 - a. This project requires a Certificate of Substantial Completion.
 - b. Warranties begin on a date other than the Substantial Completion date(s) (*Explain below.*)
 - c. Other (*list*): _____

This agreement becomes part of the Contract for Construction by attachment to the Contract and Standard Supplementary Conditions governed by Paragraph 9.8. This agreement does not change the provisions of the Contract except to establish a mutual understanding of the terms and expectations of "Substantial Completion". The signing parties for the City, A/E and Contractor have authority to act on behalf of their organizations and in this capacity. This agreement is executed on the date indicated below. *(It is required that this form be attached to the Bid Documents and executed at the earliest opportunity or at the preconstruction conference. Consultants, subcontractors, code inspectors, and other parties who have an interest in or are mentioned in this document should be so informed by receiving copies of the executed document.)*

BY: _____ (Signature of City Representative) _____ (Name of City Representative)

ITS: _____ DATE _____

BY: _____ (Signature of A/E Representative) _____ (Name of A/E Representative)

ITS: _____ DATE _____

By: _____ (Signature of Contractor Representative) _____ (Print or Type Name of Contractor Rep)

ITS: _____ DATE _____

00 00 16

City of Charleston

CONTRACTOR'S REQUEST FOR CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT: PRJ 2504 Fire Station #18 Renovations
(number) (name)

This is Part One of a two-part form. It is to be completed by the Contractor and delivered to the A/E. Part Two, Certificate of Substantial Completion, is to be completed by the A/E and submitted to the City for approval.

CERTIFICATION

I hereby certify that Substantial Completion has been accomplished in conformance with the requirements of the Contract. This certification declares that:

- A. The remaining work is not disruptive to the function of the facility and is limited to items minor in scope and nature.
- B. The required Contractor's Punch List is attached. (*Failure to include incomplete work does not relieve the Contractor of the responsibility to complete or correct the Work.*)
- C. All other requirements of the Contract have been accomplished, including delivery of all operational and maintenance manuals, record drawings, maintenance training, warrantee certificates and start-up activities.

SPECIAL CONDITIONS OR STIPULATIONS CONCERNING THE COMPLETION OF PUNCH LIST ITEMS OR EXPLANATIONS OF PARTIAL SUBSTANTIAL COMPLETION:

CONTRACTOR: _____
(Signature of Contractor Representative) (Print or Type Name of Contractor Rep) Date

INSTRUCTIONS TO THE CONTRACTOR:

Forward this completed form with all required attachments to the A/E for approval, with copy to the City.

ATTACHMENTS:

- 1. Contractor's Punch List.
- 2. Acceptance letters by other agencies/entities having approval authority (water supply, wastewater treatment, fire and licensing etc.)
- 3. Other attachments per Contract Documents

A/E: I ___ concur ___ do not concur that the Work is ready for inspection and testing.

(Signature of A/E Representative) (Print or type Name of A/E Rep) (Date)

INSTRUCTIONS TO THE A/E:

- 1. If concur, return this completed form to the Contractor, with a copy to the City, and schedule a date for inspection mutually agreeable to Contractor, A/E and City.
- 2. If not concur, state reason(s) below. Attach additional sheets if needed. Return completed form to the Contractor with copy to the City.

City of Charleston
CERTIFICATE OF FINAL COMPLETION

PROJECT: PRJ 2504 Fire Station #18 Renovations
(Number) (Name)

CONTRACTOR'S NOTIFICATION AND CERTIFICATION

I hereby notify the A/E and the City that the Work for the above Project is or will be fully completed on the date stated below. All items of punch-list and all items required by the Construction Documents have been completed and all Work is in conformance with the Contract Documents. The Facility is or will be ready for FINAL INSPECTION and TESTING on _____.
(Date)

CONTRACTOR: _____

BY: _____
(Signature of Contractor Representative)

(Print or type Name of Contractor Representative)

ITS: _____

A/E's CERTIFICATE AND CITY ACCEPTANCE OF FINAL COMPLETION

The A/E and City agree that the Project is complete and the Final Inspection of the Project was acceptable. Final Completion of the Project is hereby declared to be effective on the date stated below.

SPECIAL CONDITIONS OR STIPULATIONS CONCERNING FINAL COMPLETION

A/E's CERTIFICATION:

BY: _____
(Signature of A/E Representative)

(Print or Type Name of A/E Rep)

ITS: _____

Date of Final Completion

CITY ACCEPTANCE:

BY: _____
(Signature of City Representative)

(Print or Type Name of City Rep)

ITS: _____

Date of Acceptance

SECTION 00 31 00
AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of the Contract Documents, as follows:

- B. Asbestos and Lead Paint Assessment:
 - 1. Asbestos and Lead-based Paint Assessment, City of Charleston – Fire Station #18, 235 Seven Farms Drive, Charleston, SC, prepared by S&ME, Project Number 4213-18-043 dated April 25, 2018.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION



**Asbestos and Lead-based Paint Assessment Report
City of Charleston - Fire Station #18
235 Seven Farms
Charleston, South Carolina
S&ME Project No. 4213-18-048**

Assessment Performed and Report Prepared by:

A handwritten signature in black ink, appearing to read "James L. McMillan".

4-25-18

James L. McMillan (SCDHEC Accreditation #BI-01643) Date

PREPARED FOR:

City of Charleston, Department of Parks
823 Meeting Street
Charleston, SC 29403

PREPARED BY:

S&ME, Inc.
620 Wando Park Boulevard
Mt Pleasant, SC 29464

April 25, 2018



April 25, 2018

City of Charleston, Department of Parks
823 Meeting Street
Charleston, South Carolina 29403

Attention: Mr. Leon Patat, Superintendent
patatl@charleston-sc.gov

Reference: **Asbestos and Lead-based Paint Assessment Report**
City of Charleston - Fire Station #18
235 Seven Farms Drive
Charleston, South Carolina
S&ME Project No. 4213-18-043

Dear Mr. Patat:

S&ME, Inc. (S&ME) is pleased to provide the enclosed report detailing the asbestos and lead-based paint assessment of the structure located at the referenced site. The attached report presents the findings of S&ME's evaluation conducted on April 9, 2018. The assessment was performed in general accordance with S&ME Proposal 42-1800163R dated February 26, 2018. The enclosed report includes the executive summary, project background, assessment procedures, findings and results, and conclusions and recommendations for the proper treatment of asbestos containing materials and lead-based paint.

This report is provided for the sole use of the City of Charleston and its assignees. Use of this report by any other parties will be at such party's sole risk and S&ME, Inc. disclaims liability for any such use or reliance by third parties. The results presented in this report are indicative of conditions only during the time of the assessment and of the specific areas referenced. The information provided in this assessment report should not be used as a bidding document, and field conditions should be verified.

We appreciate the opportunity to provide you with our industrial hygiene services. If you have any questions concerning this report, please call us at (843) 884-0005.

Sincerely,

S&ME, Inc.

A handwritten signature in blue ink that reads "James L. McMillan".

James L. McMillan
Staff Industrial Hygienist

A handwritten signature in blue ink that reads "James L. Killingsworth".

James L. Killingsworth, CHMM
Environmental Services Area Manager/V.P.



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Appendices

Appendix I – Summary of Asbestos Results

Appendix II – Diagram of Bulk Sample Locations

Appendix III - Copy of Inspector’s SCDHEC License

Appendix IV- Laboratory Analysis Sheets and Chain of Custody Records

Appendix V- Summary of XRF Readings



◆ Executive Summary

An asbestos and lead-based paint assessment was conducted on April 9, 2018, of the interior and exterior of Fire Station #18 located at 235 Seven Farms Drive in Daniel Island, South Carolina. The purpose of the assessment was to identify the presence of asbestos containing materials (ACMs) and lead-based paint associated with the referenced structure to support planned renovation activities. The assessment also complies with federal, state, and local asbestos requirements regarding identification of ACMs that may be disturbed due to renovation or demolition.

The Fire Station is two-story, approximately 5,200 square feet in size, situated on a concrete slab on-grade, with a flat rubber membrane roof. The structure also includes a large bay area used for vehicle maintenance and storage. Interior finishes consist of drywall walls and ceilings, suspended ceilings, and vinyl tile, concrete, and ceramic floors. Exterior finishes consist of brick-veneer walls. The structure was occupied on the day of our site visit.

Asbestos

The suspect ACMs sampled and analyzed as part of this assessment included drywall and associated joint compound, mastic associated with heating, ventilating, and air conditioning (HVAC) ductwork, fire-stop mastic, acoustical ceiling tiles, mastic associated with the underside of a metal sink, and vinyl floor tiles and associated mastics. Of the representative materials sampled and analyzed as part of this assessment, no ACMs were identified.

The Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) defines a material an ACM if an asbestos content greater than one percent (>1%) is detected in a representative sample.

If additional suspect ACMs not addressed in this report are discovered during the planned renovation activities, bulk samples must be collected by a SCDHEC licensed inspector and analyzed for asbestos content prior to disturbance or disposal of the suspect material(s). This report should also be provided to the contractor(s) to assist with compliance with applicable State and Federal regulations.

Lead-based Paint Assessment

A lead-based paint assessment was performed on April 9, 2018, concurrently with the asbestos assessment, of representative painted components associated with the interior and exterior of the referenced structure. The components were analyzed using direct measurement X-Ray Fluorescence (XRF) technology using a Thermo Scientific XLp 302 (serial #25910). For the purpose of this assessment, painted surfaces with lead concentrations meeting the SCDHEC disposal limit (0.7 mg/cm²) are considered lead-based paint.

Of the representative suspect painted components tested, none exhibited lead concentrations meeting the SCDHEC disposal limit of 0.7 mg/cm². Low levels of lead were present which may be applicable to the standards of the OSHA 29 CFR 1926.62 (Lead in Construction) dependent upon the tasks impacting those surfaces.



**Asbestos and Lead-based Paint Assessment Report
City of Charleston - Fire Station #18**

235 Seven Farms Drive
Charleston, South Carolina
S&ME Project No. 4213-18-043

Destructive actions to paint containing detectable levels of lead (e.g. component removal, demolition, sanding, grinding, burning, paint preparation, etc.) will require the contractor comply with the standards of the OSHA regulation 29 CFR 1926.62 (Lead in Construction), including but not limited to training, initial exposure monitoring, the use of personal protective equipment, and medical surveillance.

This summary is for convenience of the reader and should not be completely relied upon without reviewing the full contents of this report, including appended materials.



1.0 Background

S&ME, Inc. (S&ME) was contracted by the City of Charleston, Department of Parks to perform an asbestos and lead-based paint assessment of Fire Station #18 located at 235 Seven Farms Drive in Daniel Island, South Carolina. The assessment was requested to identify the presence of asbestos containing materials (ACMs) and lead-based paint associated with the structure due to planned renovation activities. The assessment also complies with federal, state, and local asbestos requirements regarding identification of asbestos containing building materials that may be disturbed due to renovation or demolition.

The asbestos assessment was conducted to assess, sample, and identify ACMs in accordance with regulatory requirements. The identification of ACMs will aid in the prevention of occupational exposures and/or environmental releases of airborne asbestos. Identification of ACMs also complies with Title 40 Code of the Federal Regulations, part 61, and State regulation 61-86.1 enforced by the South Carolina Department of Health and Environmental Control (SCDHEC), along with Title 29 Code of Federal Regulations, part 1926 enforced by the Occupational Safety and Health Administration (OSHA). The following sections describe the assessment procedures used, results of the suspect ACMs sampled and analyzed, and conclusions and recommendations related to ACMs.

The purpose of the lead-based paint testing was to assess and identify lead-based paint coatings associated with the interior and exterior of the referenced structure. The identification of these materials will aid in the compliance of occupational exposure (OSHA) and/or environmental releases of airborne lead dust in accordance with OSHA 29 CFR 1926.62 (Lead in Construction) and provide information to determine proper disposal of lead-based paint coated components and debris in accordance with the SCDHEC and the Environmental Protection Agency (EPA).

2.0 Site and Project Description

2.1 Purpose

The purpose of the assessment was to identify the presence of ACM and lead-based paint prior to renovation activities. The assessment included the interior and exterior of the referenced structure. An assessment strategy appropriate for this purpose was presented in our proposal and is described in this report. The report should be interpreted only with regard to the specific location and materials referenced.

2.2 Site Description

Fire Station #18 is two-story, approximately 5,200 square feet in size, situated on a concrete slab on-grade, with a flat membrane roof. The structure also includes a large bay area used for vehicle maintenance and storage. Interior finishes consist of drywall walls and ceilings, suspended ceilings, and vinyl tile, concrete, and ceramic floors. Exterior finishes consist of brick-veneer walls. The structure was occupied on the day of our site visit.



3.0 Assessment Procedures

3.1 Asbestos Containing Materials

The assessment was performed by observing and sampling suspect ACMs associated with the structure located at 235 Seven Farms Drive in Daniel Island, South Carolina. The possibility exists that suspect materials were undetected in inaccessible areas such as wall voids and flooring overlays. If additional suspect ACMs not identified in this report are discovered during destructive activities, bulk samples must be collected by a SCDHEC licensed inspector and analyzed for asbestos content prior to disturbance or disposal of the suspect materials.

A sampling strategy was developed to provide representative samples in accordance with the SCDHEC and EPA. Bulk samples of suspect ACMs were collected by a SCDHEC licensed inspector. The bulk samples were then extracted from suspect ACMs and recorded on a chain of custody record and submitted to our in-house Polarized Light Microscopy (PLM) laboratory. The samples were subsequently analyzed by PLM, and confirmation analysis was performed by Transmission Electron Microscopy (TEM) by *EMSL Analytical*, for non-friable organically bound materials reported negative by PLM. The laboratories are located in Charlotte, North Carolina and are accredited by the National Voluntary Laboratory Accreditation Program (NVLAP), which is administered by the National Institute of Standards and Technology.

Polarized Light Microscopy (PLM)

The suspect materials were analyzed by trained microscopists using PLM techniques coupled with dispersion staining in accordance with EPA Test Method Title 40 Code of Federal Regulations, Chapter I (1-1-87 edition), Part 763, Subpart F-APPENDIX A. This method identifies asbestos mineral fibers based on six optical characteristics: morphology, birefringence, refractive index, extinction angle, sign of elongation and dispersion staining colors. The laboratory analysis reports the specific type of asbestos identified (there are six asbestos minerals) and the percentage of asbestos present.

Transmission Electron Microscopy (TEM)

Suspect non-friable organically bound materials, exhibiting negative results via PLM analysis, were analyzed by trained microscopists via TEM, in accordance with ASTM E2356 per SCDHEC requirements.

3.2 Lead-based Paint

Lead-based paint testing was performed on representative painted components associated with the interior and exterior of the referenced structure. The components were analyzed with a Thermo Scientific XLP-302 XRF spectrum analyzer (serial #25910). The suspect painted finishes were selected based on the color of the topcoat and the underlying paint layers and/or the substrate on which it was applied. The possibility exists that lead-based paint finishes are present in those inaccessible areas such as pipe chases, wall voids, etc. The SCDHEC defines a lead-based paint as any paint containing lead at concentrations equaling 0.7 mg/cm² or greater by XRF



testing. For the purpose of the assessment, paint containing 0.7 mg/cm^2 or greater was considered lead-based paint due to the planned renovation activities.

The OSHA does not recognize a threshold level of lead for definition purposes, only the airborne concentration of lead a worker is exposed. The current OSHA regulations recognize an airborne action level of 30 micrograms per cubic meter ($\mu\text{g/m}^3$) during an eight-hour day and a permissible exposure limit of $50 \mu\text{g/m}^3$.

4.0 Findings and Results

4.1 Asbestos

The suspect ACMs sampled on April 9, 2018, and analyzed as part of this assessment included drywall and associated joint compound, mastic associated with heating, ventilating, and air conditioning (HVAC) ductwork, fire-stop mastic, acoustical ceiling tiles, mastic associated with the underside of a metal sink, and vinyl floor tiles and associated mastics. Of the representative materials sampled and analyzed as part of this assessment, no ACMs were identified.

The EPA and the OSHA defines a material as an ACM if an asbestos content of greater than one percent ($>1\%$) is detected in a representative sample.

A summary of asbestos results is provided in Appendix I, and exhibits the sample number, location, type of material tested, approximate quantity of the material sampled, condition of the material, and corresponding result for each sample. A diagram of bulk sample locations is provided in Attachment II, and a copy of the inspector's SCDHEC license is provided in Attachment III. Copies of the laboratory analyses and chain-of-custody records are provided in Attachment IV.

4.2 Lead-based Paint

Based on the assessment and testing performed on April 9, 2018, of the painted components associated with the referenced structure, no lead levels meeting the SCDHEC limit of 0.7 mg/cm^2 were identified. Low levels of lead were present which may be applicable to the standards of the OSHA 29 CFR 1926.62 (Lead in Construction) dependent upon the tasks impacting those surfaces.

A summary of XRF readings is provided in Appendix V, and should be reviewed in full.

5.0 Conclusions and Recommendations

The asbestos and lead-based paint assessment performed on April 9, 2018, of Fire Station #18 located at 235 Seven Farms Drive in Daniel Island, South Carolina did not identify the presence of ACMs and lead-based paint applicable to the SCDHEC and EPA disposal standards. Low levels of lead were identified that may be applicable



to the standards of the OSHA. This report should be provided to the contractor(s) to assist with compliance with applicable State and Federal regulations.

5.1 Asbestos

If additional suspect materials not addressed in this report are discovered during renovation activities, work impacting those suspect materials must cease and bulk samples must be collected by a SCDHEC licensed inspector and analyzed for asbestos content, prior to disturbance or disposal.

5.2 Lead-based Paint

Destructive actions to paint containing detectable levels of lead (e.g. component removal, demolition, sanding, grinding, burning, paint preparation, etc.) may require the contractor comply with the standards of the OSHA regulations 29 CFR 1926.62 (Lead in Construction) depending upon the planned impacts to those subject paints. OSHA compliance may require training, initial exposure monitoring, the use of personal protective equipment, and medical surveillance.

Paint coatings may be present that contain low levels of lead that cannot be detected by XRF, and may be applicable to OSHA regulations 29 CFR 1926.62. The quantities reported by XRF may be useful in determining the relative risk associated with various demolition tasks, for example disturbances to paints with low lead levels may be less likely to result in airborne lead exposures in excess of the OSHA Action Level.

6.0 Assumptions and Limitations

This report is provided for the sole use of the City of Charleston. Use of this report by any other parties will be at such party's sole risk, and S&ME disclaims liability for any such use or reliance by third parties. The results presented in this report are indicative of conditions only during the time of the sampling period and of the specific areas referenced. Under no circumstances is this report to be used as a bidding document, or as a project design or specification.

S&ME performed the services in accordance with generally accepted practices of reputable environmental consultants undertaking similar studies at the same time and in the same geographical area. S&ME has endeavored to meet this standard of care. No other warranty, expressed or implied, is intended or made with respect to this report or S&ME's services. Users of this report should consider the scope and limitations related to these services when developing opinions as to risks associated with the site.

The findings of the asbestos and lead-based paint assessment were based largely on visual observations within the amount of time available. The findings do not warrant that all asbestos containing materials and lead-based paint have been identified; asbestos-containing materials and lead-based paint could be present in areas not readily-accessible to observation. In addition, the actual locations and quantities of materials determined to contain asbestos may vary from those herein. Apparent homogeneous sampling areas may vary in actual asbestos content due to previous renovations, maintenance or related operations. The possibility exists that



Asbestos and Lead-based Paint Assessment Report
City of Charleston - Fire Station #18
235 Seven Farms Drive
Charleston, South Carolina
S&ME Project No. 4213-18-043

suspect materials were undetected in inaccessible or concealed areas such as under carpeting or multiple flooring layers, and inside pipe chases or wall voids. If additional suspect materials are discovered during the planned destructive activities, bulk samples should be collected by an asbestos inspector and analyzed for asbestos content.

Appendices

Appendix I – Summary of Asbestos Results



Table I: Summary of Asbestos Results

HA	Material Description	Material Location	² Approx. Quantity	Cat. (F/I/II)	Type	Condition/ Potential for Disturbance	Sample Number	Sample Location	¹ Type and Percent Asbestos
DW	Drywall	Throughout	7,000 SF	F	N/A	N/A	235-DW-01	1st Floor Corridor	ND
							235-DW-02	Break Room	ND
JC	Joint Compound	Throughout	7,000 SF	F	N/A	N/A	235-DW-03	2nd Floor Corridor	ND
							235-JC-01	1st Floor Corridor	ND
							235-JC-02	Break Room	ND
							235-JC-03	2nd Floor Corridor	ND
							235-JC-04	Kitchen	ND
							235-JC-05	Captain's Room	ND
							235-JC-06	Bunk Room	ND
FP	Fire-Proofing	1st Floor Corridor	1,700 SF	F	N/A	N/A	235-JC-07	2nd Floor Utility	ND
							235-FP-01	1st Floor Corridor	ND
							235-FP-02	1st Floor Corridor	ND
							235-FP-03	1st Floor Corridor	ND
							235-FP-04	1st Floor Corridor	ND
							235-FP-05	1st Floor Corridor	ND
							FC	Fire Caulking	Above Suspended Ceiling
235-FC-02	2nd Floor Corridor	ND							
³ 235-FC-03	2nd Floor Corridor	ND							
CT	Ceiling Tile (2X2 white)	Various Areas Throughout	4,680 SF	F	N/A	N/A	235-CT-01	1st Floor Corridor	ND
							235-CT-02	Break Room	ND
							235-CT-03	2nd Floor Corridor	ND



Table I: Summary of Asbestos Results

HA	Material Description	Material Location	² Approx. Quantity	Cat. (F/I/II)	Type	Condition/ Potential for Disturbance	Sample Number	Sample Location	¹ Type and Percent Asbestos
DM	Mastic associated with HVAC Ductwork (beige)	Above Suspended Ceiling	845 SF	NF Cat I	N/A	N/A	235-DM-01	1st Floor Corridor	ND
							235-DM-02	Women's Restroom	ND
							³ 235-DM-03	2nd Floor Corridor	ND
SC	Mastic (black) associated with the underside of a metal sink	Kitchen and Conference Room Sinks	8 SF	NF Cat I	N/A	N/A	235-SC-01	Kitchen	ND
							235-SC-02	Conference Room	ND
							³ 235-SC-03	Kitchen	ND
FT1	Floor Tile (12" orange) and Mastic (yellow)	Various Areas	225 SF	NF Cat I	N/A	N/A	235-FT1-01	1st Floor Corridor	ND
							235-FT1-02	Bunk Room	ND
							³ 235-FT1-03	2nd Floor Corridor	ND
FT2	Floor Tile (12" blue) and Mastic (yellow)	Various Areas	670 SF	NF Cat I	N/A	N/A	235-FT2-01	Bunk Room	ND
							235-FT2-02	1st Floor Corridor	ND
							³ 235-FT2-03	Watch Room	ND
FT3	Floor Tile (12" grey) and Mastic (tan)	Various Areas	1,150 SF	NF Cat I	N/A	N/A	235-FT3-01	Captain's Room	ND
							235-FT3-02	Break Room	ND
							³ 235-FT3-03	Police Room	ND



Table I: Summary of Asbestos Results

HA	Material Description	Material Location	² Approx. Quantity (F/ID)	Cat.	Type	Condition/ Potential for Disturbance	Sample Number	Sample Location	¹ Type and Percent Asbestos
FT4	Floor Tile (12" dark grey) and Mastic (tan)	Police Area	365 SF	NF Cat I	N/A	N/A	235-FT4-01 235-FT4-02 ³ 235-FT4-03	Police Room Police Room Police Room	ND ND ND ND ND ND

ND = No Asbestos Detected LDP = Low Potential for Disturbance G = Good F = Friable
 N/A = Not Applicable PD = Potential for Disturbance D = Damaged NF = Non-Friable
 SF = Square Feet PSD = Potential for Significant Disturbance SD = Significantly Damaged EA = Each
 LF = Linear Feet Cat I = Category I Cat II = Category II

¹ EPA, SCDHEC and OSHA defines a material as asbestos containing if an asbestos content greater than one percent (> 1%) is detected in a representative sample.

² Quantities are estimated, and should not be used for bidding purposes, as field conditions should be verified.

³ Samples analyzed by TEM to confirm negative results reported by PLM analysis.

Appendix II – Diagram of Bulk Sample Locations



ASBESTOS AND LEAD-BASED PAINT ASSESSMENT

CITY OF CHARLESTON FIRE STATION 18 - GROUND FLOOR
235 SEVEN FARMS DRIVE
CHARLESTON, SOUTH CAROLINA

SCALE	NTS
DATE	4-25-2018
PROJECT NUMBER	4213-18-048
FIGURE NO.	1

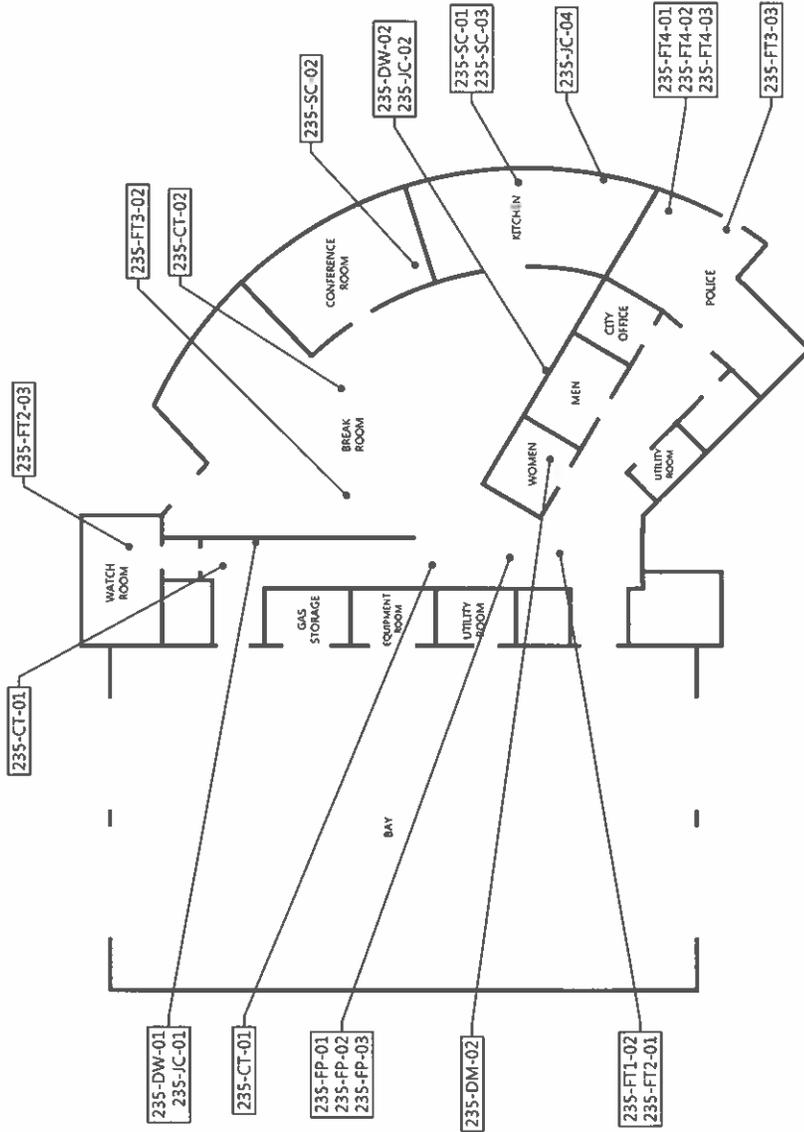


NOTES:

- NO ASBESTOS WAS DETECTED IN THE BULK SAMPLES COLLECTED AND ANALYZED.
- NO LEAD MEETING THE SCDEHCD DISPOSAL LIMIT OF 0.7 mg/cm² WERE DETECTED.



SEVEN FARMS DRIVE



LEGEND

235-XX-XX BULK SAMPLE LOCATION



ASBESTOS AND LEAD-BASED PAINT ASSESSMENT

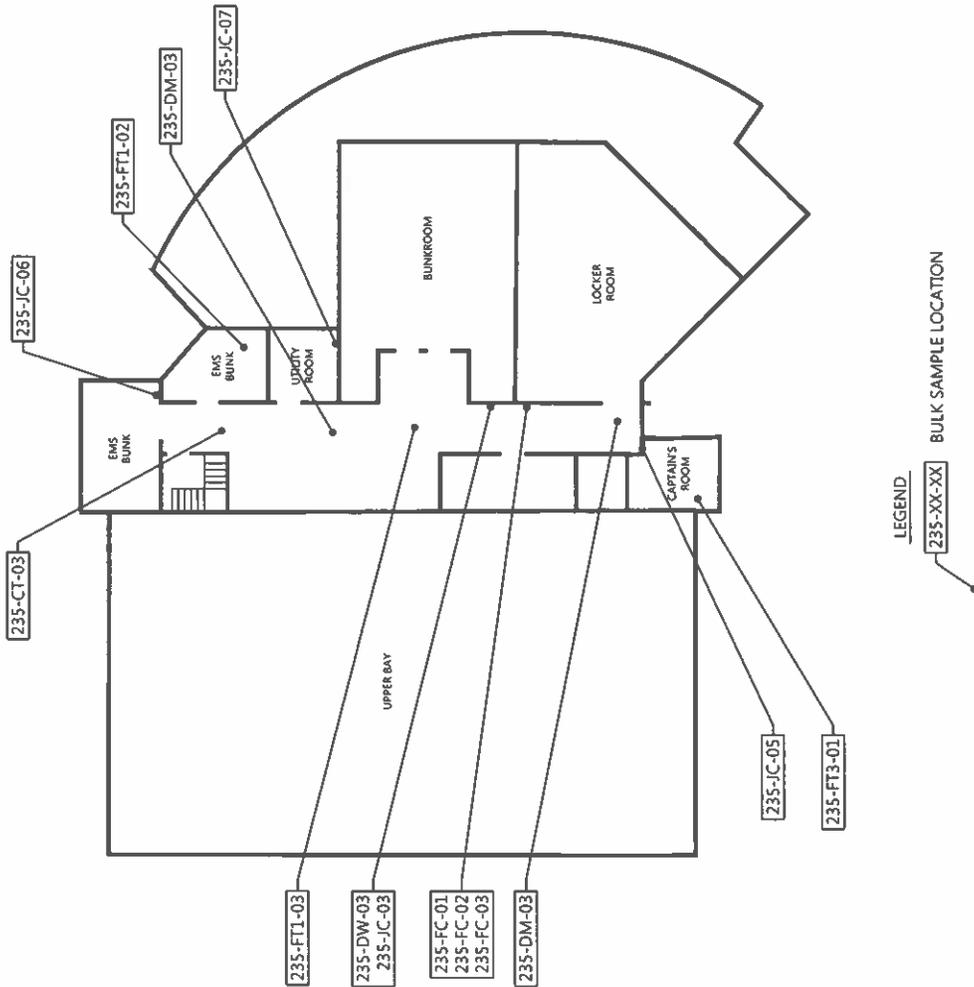
CITY OF CHARLESTON FIRE STATION 18 - SECOND FLOOR
235 SEVEN FARMS DRIVE
CHARLESTON, SOUTH CAROLINA

SCALE:	NTS
DATE:	4-23-2018
PROJECT NUMBER:	4213-18-048
FIGURE NO.:	

2



NOTES:
 NO ASBESTOS WAS DETECTED IN THE BULK SAMPLES COLLECTED AND ANALYZED.
 NO LEAD MEETING THE SCDFHC DISPOSAL LIMIT OF 0.7 mg/cm² WERE DETECTED.



LEGEND
 235-XX-XX BULK SAMPLE LOCATION

Appendix III- Copy of Inspector's SCDHEC License



**South Carolina
Department of Health and Environmental Control
Asbestos License**

John McEathron

SCDHEC ISSUED
Asbestos ID Card

Everett J. Mceathron

	AIRSAMPLER AS-00235	Expiration Date
	CONSULTBI BI-00794	12/04/18
		11/29/18

*Air Sampler AS-00235
Building Inspector BI-00794*

**Appendix IV- Laboratory Analysis Sheets and Chain of Custody
Records**



9771D Southern Pine Boulevard
 Charlotte, NC 28273
 704-940-1830 Fax 704-565-4929
 NVLAP Lab Code 102075-0

POLARIZED LIGHT MICROSCOPY
 Performed by EPA 600/R-93/116 Method

Asbestos Analysis Summary

Client Name Charleston Branch 620 Wando Park Blvd.
Client Job C of C Fire Dept Station 18 Mt. Pleasant SC 29464

Date Received 4/11/2018
Date Analyzed 4/12/2018

Job Number	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
18-2728	235-DW-01	TAN/BEIGE FIBROUS		ND	5 CELLULOSE 2 GLASS	93 GYPSUM
18-2729	235-DW-02	TAN/BEIGE FIBROUS		ND	90 CELLULOSE 2 GLASS	8 GYPSUM
18-2730	235-DW-03	TAN/BEIGE FIBROUS		ND	95 CELLULOSE 1 GLASS	4 GYPSUM
18-2731	235-JC-01	WHITE NONFIBROUS		ND		100 OTHER

Analyzed by: Jane Wasilewski
 Additional Comments:

Jane Wasilewski
 Laboratory Manager

For heterogeneous samples easily separated into subsamples, and for layered samples, each component is analyzed separately. ND = None Detected (Asbestos Not Present in Representative Sample), RCP (Refractory Ceramic Fiber) The results relate only to the items tested.
 The sample may not be fully representative of the larger material in question. This sheet may not be reproduced except with permission from SME, Inc. This report may not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. Although Polarized Light Microscopy (PLM/Dispersion Staining) (Method EPA 600/R-93/116) is the specified method for analysis of bulk material samples for asbestos under the EPA Asbestos Hazard Emergency Response Act, there have been reports that this method may not identify asbestos when fiber sizes are extremely small or if they are bound in a resinous material. Such materials include floor tile, mastic and asphaltic roofing. Currently, reanalysis by Transmission Electron Microscopy (TEM) to verify results of <1% or "None Detected" for these materials is recommended.

Job Number 4213-18-048

Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
18-2732	235-JC-02	WHITE NONFIBROUS		ND		100 OTHER
18-2733	235-JC-03	WHITE NONFIBROUS		ND		100 OTHER
18-2734	235-JC-04	WHITE NONFIBROUS		ND		100 OTHER
18-2735	235-JC-05	WHITE NONFIBROUS		ND		100 OTHER
18-2736	235-FP-01	GREY FIBROUS		ND	10 CELLULOSE	90 OTHER
18-2737	235-FP-02	GREY FIBROUS		ND	10 CELLULOSE	90 OTHER

Analyzed by: Jane Wasilewski
Additional Comments:

Jane Wasilewski
Laboratory Manager

For heterogeneous samples easily separated into subsamples, and for layered samples, each component is analyzed separately. ND = None Detected (Asbestos Not Present in Representative Sample), RCF= (Refractory Ceramic Fiber) The results relate only to the items tested. The sample may not be fully representative of the larger material in question. This sheet may not be reproduced except with permission from SME, Inc. This report may not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. Although Polarized Light Microscopy (PLM/Dispersion Staining) (Method EPA 600/R-93/116) is the specified method for analysis of bulk material samples for asbestos under the EPA Asbestos Hazard Emergency Response Act, there have been reports that this method may not identify asbestos when fiber sizes are extremely small or if they are bound in a resinous material. Such materials include floor tile, mastic and asphaltic roofing. Currently, reanalysis by Transmission Electron Microscopy (TEM) to verify results of <1% or "None Detected" for these materials is recommended.

Job Number 4213-18-048

Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
18-2738	235-FP-03	GREY FIBROUS		ND	10 CELLULOSE	90 OTHER
18-2739	235-FC-01	BLUE PLIABLE		ND		100 OTHER
18-2740	235-FC-02	BLUE PLIABLE		ND		100 OTHER
18-2742	235-JC-06	WHITE NONFIBROUS		ND		100 OTHER
18-2743	235-JC-07	WHITE NONFIBROUS		ND		100 OTHER
18-2744	235-CT-01	GREY FIBROUS		ND	95 MINERAL WOOL 1 CELLULOSE	4 PERLITE

Analyzed by: Jane Wasilewski
Additional Comments:

Jane Wasilewski
Laboratory Manager

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Job Number 4213-18-048

Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
18-2745	235-CT-02	GREY FIBROUS		ND	95 MINERAL WOOL 1 CELLULOSE	4 PERLITE
18-2746	235-CT-03	GREY FIBROUS		ND	95 MINERAL WOOL 1 CELLULOSE	4 PERLITE
18-2747	235-DM-01	GREY PLIABLE		ND	2 CELLULOSE	98 OTHER
18-2748	235-DM-02	GREY PLIABLE		ND	2 CELLULOSE	98 OTHER
18-2750	235-SC-01	BLACK NONFIBROUS		ND		100 OTHER
18-2751	235-SC-02	BLACK NONFIBROUS		ND		100 OTHER

Analyzed by: Jane Wasilewski
Additional Comments:

Jane Wasilewski
Laboratory Manager

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Job Number 4213-18-048

Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
18-2753	235-FT1-01	ORANGE NONFIBROUS	TILE (ONLY)	ND		100 OTHER
18-2754A	235-FT1-02	ORANGE NONFIBROUS	TILE	ND		100 OTHER
18-2754B	235-FT1-02	YELLOW NONFIBROUS	MASTIC	ND		100 OTHER
18-2756A	235-FT2-01	BLUE NONFIBROUS	TILE	ND		100 OTHER
18-2756B	235-FT2-01	YELLOW NONFIBROUS	MASTIC	ND		100 OTHER
18-2757A	235-FT2-01	BLUE NONFIBROUS	TILE	ND		100 OTHER

Analyzed by: Jane Wasilewski
Additional Comments:

Jane Wasilewski
Laboratory Manager

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Job Number 4213-18-048

Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
18-2757B	235-FT2-01	YELLOW NONFIBROUS	MASTIC	ND		100 OTHER
18-2759A	235-FT3-01	GREY NONFIBROUS	TILE	ND		100 OTHER
18-2759B	235-FT3-01	YELLOW NONFIBROUS	MASTIC	ND		100 OTHER
18-2760A	235-FT3-02	GREY NONFIBROUS	TILE	ND		100 OTHER
18-2760B	235-FT3-02	YELLOW NONFIBROUS	MASTIC	ND		100 OTHER
18-2762A	235-FT4-01	GREY NONFIBROUS	TILE	ND		100 OTHER

Analyzed by: Jane Wasilewski
Additional Comments:

Jane Wasilewski
Laboratory Manager

For heterogeneous samples easily separated into subsamples, and for layered samples, each component is analyzed separately. ND = None Detected (Asbestos Not Present in Representative Sample). RCF= (Refractory Ceramic Fiber) The results relate only to the items tested.
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Job Number 4213-18-048

Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
18-2762B	235-FT4-01	YELLOW NONFIBROUS	MASTIC	ND		100 OTHER
18-2763A	235-FT4-02	GREY NONFIBROUS	TILE	ND		100 OTHER
18-2763B	235-FT4-02	YELLOW NONFIBROUS	MASTIC	ND		100 OTHER

Analyzed by: Jane Wasilewski
Additional Comments:

Jane Wasilewski
Laboratory Manager

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BULK SAMPLE
CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME				
423-18-048	City of Chester	<i>[Signature]</i>	4-10-18	1400	<i>[Signature]</i>	4/11/18	9:31 AM				
FACILITY	DATE TAKEN	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME				
Fire Dept Station 18 - 235 Saw Farms Rd	4-9-18	<i>[Signature]</i>			<i>[Signature]</i>						
SAMPLER(S)	HOMOGENEOUS AREA	MATERIAL TYPE	LAB NUMBER	DATE ANALYZED	ANALYSTS INITIALS	ASBESTOS +	N/D	ARCHIVE NUMBER	DATE ARCH	ARCHIVER INITIALS	SPECIAL INSTRUCTIONS
235-DW-01	1	Drywall	18-2728								
235-DW-02	1	I	29								
235-DW-03	1	I	30								
235-JC-01	2	Joint Compound	31								
235-JC-02	2	I	32								
235-JC-03	2	I	33								
235-JC-04	2	I	34								
235-JC-05	2	I	35								
235-FR-01	3	Fire Proofing	36								
235-FR-02	3	I	37								
235-FR-03	3	I	38								
235-FC-01	4	Fire Caulker	39								
235-FC-02	4	I	40								
235-FC-03	4	I	41								TEM
235-JC-06	2	Joint Compound	2742								

ALL SAMPLES WILL BE DISPOSED OF NINETY DAYS AFTER ANALYSIS UNLESS OTHERWISE REQUESTED

5 Dps TAT
3 Dps TAT
Positive Stop

MATERIAL TYPES

A <4" Pipe Fitting	M A.H.U. Exp. Jt
B - 4-8" Pipe Fitting	N Ceiling/Wall Tile
C - 9-14" Pipe Fitting	O Fiberboard
D >14" Pipe Fitting	P Other
E <4" Pipe	(See notes Front or back)
F 4-8" Pipe	
G 9-14" Pipe	
H >14" Pipe	
I Spray-On/Trowel	
J Floor Tile	
K Tanks/Boiler	
L A.H.U. Insul.	

SAME SF-002 (REV. 5/10) This document was prepared pursuant to a specific agreement to address the unique requirements of an SAME client. Prior to further use, an SAME professional should be contacted for a complete explanation of its preparation and contents.



BULK SAMPLE CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:					
4213-18-048	City of Charleston	<i>[Signature]</i>	4-10-18	1400	<i>[Signature]</i> 4/11/18					
FACILITY		RELINQUISHED BY:	DATE	TIME	RECEIVED BY:					
Fire Dept. Station 18-235 Seven Farms Rd										
SAMPLER(S)		RELINQUISHED BY:	DATE	TIME	RECEIVED BY:					
John McEffer, Antoinette Prober										
SAMPLE #	HOMOGENEOUS AREA	MATERIAL TYPE	LAB NUMBER	DATE ANALYZED	ANALYSTS INITIALS	ASBESTOS + N/D	ARCHIVE NUMBER	DATE ARCH	ARCHIVER INITIALS	SPECIAL INSTRUCTIONS
235-1C-07	2	↓	18-27	43						
235-CT-01	5	Ceiling Tile		44						
235-CT-02	5	↓		45						
235-CT-03	5	↓		46						
235-DM-01	6	Duct Mastic		47						
235-DM-02	6	↓		48						
235-DM-03	6	↓		49					TEM	
235-SC-01	7	Sink		50						
235-SC-02	7	Coaming		51						
235-SC-03	7	↓		52					TEM	
235-F1-01	8	Tile/mastic		53						
235-F1-02	8	↓		54						
235-F1-03	8	↓		55					TEM	
235-F1-01	9	Tile Mastic		56						
235-F1-02	9	↓		2757						

ALL SAMPLES WILL BE DISPOSED OF NINETY DAYS AFTER ANALYSIS UNLESS OTHERWISE REQUESTED

5 Dry TAT
3 Dry TAT
Positive Stop

MATERIAL TYPES

- | | |
|--|--|
| <ul style="list-style-type: none"> A <4" Pipe Fitting B 4-8" Pipe Fitting C 9-14" Pipe Fitting D >14" Pipe Fitting E <4" Pipe F 4-8" Pipe G 9-14" Pipe H >14" Pipe I Spray-On/Trowel J Floor Tile K Tanks/Boiler L A.H.U. Insul. | <ul style="list-style-type: none"> M A.H.U. Exp. Jt. N Ceiling/Wall Tile O Fiberboard P Other <p>(See notes Front or back)</p> |
|--|--|

S&ME 551-002 (REV. 3/05) This document was prepared pursuant to a specific agreement to address the unique requirements of an S&ME client. Prior to further use, an S&ME professional should be contacted for a complete explanation of its preparation and contents.



EMSL Analytical, Inc.

10801 Southern Loop Blvd Pineville, NC 28134
Tel/Fax: (704) 525-2205 / (704) 525-2382
<http://www.EMSL.com> / charfottelab@emsl.com

EMSL Order: 411802951
Customer ID: SMEI54
Customer PO:
Project ID:

Attention: Jane Wasilewski
S&ME, Inc.
9771D Southern Pine Blvd.
Charlotte, NC 28273
Phone: (704) 940-1830
Fax: (704) 565-4929
Received Date: 04/13/2018 10:15 AM
Analysis Date: 04/14/2018
Collected Date:
Project: 4213-18-048 (Fire Station 18)

Test Report: Asbestos Analysis of Non-Friable Organically Bound Materials by TEM via EPA/600/R-93/116 Section 2.5.5.1

Sample ID	Description	Appearance	% Matrix Material	% Non-Asbestos Fibers	Asbestos Types
235-FC-03 411802951-0001	Caulk	White/Blue Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-DM-03 411802951-0002	Mastic	Beige Fibrous Homogeneous	98.9	1.1 Fibrous_Other	No Asbestos Detected
235-SC-03 411802951-0003	Sink Mastic	Black Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT1-03 411802951-0004	Tile	Pink Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT1-03 411802951-0005	Mastic	Tan Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT2-03 411802951-0006	Tile	Blue Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT2-03 411802951-0007	Mastic	Tan Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT3-03 411802951-0008	Tile	Gray Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT3-03 411802951-0009	Mastic	Tan Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT4-03 411802951-0010	Tile	Gray Non-Fibrous Homogeneous	100	None	No Asbestos Detected
235-FT4-03 411802951-0011	Mastic	Tan Non-Fibrous Homogeneous	100	None	No Asbestos Detected

This laboratory is not responsible for % asbestos in total sample when the residue only is submitted for analysis. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. Samples received in good condition unless otherwise noted. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample.

Samples analyzed by EMSL Analytical, Inc. Pineville, NC
Initial report from: 04/16/2018 08:30:00



EMSL Analytical, Inc.

10801 Southern Loop Blvd Pineville, NC 28134
Tel/Fax: (704) 525-2205 / (704) 525-2382
<http://www.EMSL.com> / charlottelab@emsl.com

EMSL Order: 411802951
Customer ID: SMEI54
Customer PO:
Project ID:

Attention: Jane Wasilewski
S&ME, Inc.
9771D Southern Pine Blvd.
Charlotte, NC 28273
Phone: (704) 940-1830
Fax: (704) 565-4929
Received Date: 04/13/2018 10:15 AM
Analysis Date: 04/14/2018
Collected Date:
Project: 4213-18-048 (Fire Station 18)

Test Report: Asbestos Analysis of Non-Friable Organically Bound Materials by TEM via EPA/600/R-93/116 Section 2.5.5.1

Sample ID	Description	Appearance	% Matrix Material	% Non-Asbestos Fibers	Asbestos Types
-----------	-------------	------------	-------------------	-----------------------	----------------

Analyst(s)

Aaron Hartley (11)

Lee Plumley, Laboratory Manager
or other approved signatory

This laboratory is not responsible for % asbestos in total sample when the residue only is submitted for analysis. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. Samples received in good condition unless otherwise noted. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample.

Samples analyzed by EMSL Analytical, Inc. Pineville, NC

Initial report from: 04/16/2018 08:30:00



EMSL ANALYTICAL, INC.
LABORATORY PRODUCTS TRAINING

Asbestos Chain of Custody

EMSL Order Number (Lab Use Only):

411802951

EMSL ANALYTICAL, INC.
10801 SOUTHERN LOOP BLVD
PINEVILLE, NC 28134
PHONE: 704-525-2205
FAX: 704-525-2382

trichberg@smeinc.com & JMcMillian@smeinc.com

Company : S&ME Inc. EMSL-Bill to: Same Different
 If Bill to is Different note instructions in Comments**
 Street: 9771D Southern Pine Blvd. Third Party Billing requires written authorization from third party
 City: Charlotte State/Province: NC Zip/Postal Code: 28273 Country:
 Report To (Name): Jane Wasilewski Telephone #: 704-940-1830
 Email Address: jwasilewski@smeinc.com Also Fax #: Purchase Order:
 Project Name/Number: Please Provide Results: Fax Email
 U.S. State Samples Taken: CT Samples: Commercial/Taxable Residential/Tax Exempt

Turnaround Time (TAT) Options - Please Check
 3 Hour 6 Hour 24 Hour 48 Hour 72 Hour 96 Hour 1 Week 2 Week
 *For TEM Air 3 hr through 6 hr, please call ahead to schedule. *There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.

PCM - Air <input type="checkbox"/> Check if samples are from NY <input type="checkbox"/> NIOSH 7400 <input type="checkbox"/> w/ OSHA 8hr. TWA PLM - Bulk (reporting limit) <input type="checkbox"/> PLM EPA 600/R-93/116 (<1%) <input type="checkbox"/> PLM EPA NOB (<1%) Point Count <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%) Point Count w/Gravimetric <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%) <input type="checkbox"/> NYS 198.1 (friable in NY) <input type="checkbox"/> NYS 198.6 NOB (non-friable-NY) <input type="checkbox"/> NIOSH 9002 (<1%)	TEM - Air <input type="checkbox"/> 4-4.5hr TAT (AHERA only) <input type="checkbox"/> AHERA 40 CFR, Part 763 <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II <input type="checkbox"/> ISO 10312 TEM - Bulk <input checked="" type="checkbox"/> TEM EPA NOB <input type="checkbox"/> NYS NOB 198.4 (non-friable-NY) <input type="checkbox"/> Chatfield SOP <input type="checkbox"/> TEM Mass Analysis-EPA 600 sec. 2.5 TEM - Water: EPA 100.2 Fibers >10µm <input type="checkbox"/> Waste <input type="checkbox"/> Drinking All Fiber Sizes <input type="checkbox"/> Waste <input type="checkbox"/> Drinking	TEM - Dust <input type="checkbox"/> Microvac - ASTM D 5755 <input type="checkbox"/> Wipe - ASTM D6480 <input type="checkbox"/> Carpet Sonication (EPA 600/J-93/167) Soil/Rock/Vermiculite <input type="checkbox"/> PLM CARB 435 - A (0.25% sensitivity) <input type="checkbox"/> PLM CARB 435 - B (0.1% sensitivity) <input type="checkbox"/> TEM CARB 435 - B (0.1% sensitivity) <input type="checkbox"/> TEM CARB 435 - C (0.01% sensitivity) <input type="checkbox"/> TEM Qual. via Filtration Technique <input type="checkbox"/> TEM Qual. via Drop-Mount Technique Other: <input type="checkbox"/>
--	---	--

Check For Positive Stop - Clearly Identify Homogenous Group Filter Pore Size (Air Samples): 0.8µm 0.45µm

Samplers Name: Samplers Signature:

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
235-FC-03	caulk		
235-DM-03	Mastic		
235-SC-03	Sink Mastic		
235-FT1-03	Tile		
↓	Mastic		
235-FT2-03	Tile		
↓	Mastic		
235-FT3-03	Tile		

Client Sample # (s): Total # of Samples: 11

Relinquished (Client): Date: 4/13/18 Time:

Received (Lab): Date: 4/13/18 Time: 10:15AM W/IN

Comments/Special Instructions: Bill to S&ME, Inc., 9751 Southern Pine Blvd., Charlotte NC 28273
 ****EMAIL INVOICE TO JANE WASILEWSKI****

4213-18-048 (Fire Station 18)



EMSL Analytical, Inc.

10801 Southern Loop Blvd Pineville, NC 28134
Tel/Fax: (704) 525-2205 / (704) 525-2382
<http://www.EMSL.com> / charlottelab@emsl.com

EMSL Order: 411803064
Customer ID: SMEI51
Customer PO: 41569
Project ID:

Attention: James McMillan
S&ME, Inc.
620 Wando Park Boulevard
Mount Pleasant, SC 29464

Phone: (843) 884-0005
Fax: (843) 881-6149
Received Date: 04/18/2018 9:05 AM
Analysis Date: 04/23/2018
Collected Date: 04/17/2018

Project: 4213-18-048/ Fire Station #18

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
235-FP-04 <small>411803064-0001</small>	Fireproofing	Gray Fibrous Homogeneous	25% Cellulose	8% Ca Carbonate 67% Non-fibrous (Other)	None Detected
235-FP-05 <small>411803064-0002</small>	Fireproofing	Gray Fibrous Homogeneous	25% Cellulose	8% Ca Carbonate 67% Non-fibrous (Other)	None Detected
235-FT1-01M <small>411803064-0003</small>	Mastic	Tan Fibrous Homogeneous	<1% Synthetic	5% Ca Carbonate 95% Non-fibrous (Other)	None Detected

Analyst(s)

Anupriya Tyagi (2)
Sarah Breneman (1)

Lee Plumley, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Reporting limit is 1%

Samples analyzed by EMSL Analytical, Inc. Pineville, NC NVLAP Lab Code 200841-0, VA 3333 00312

Initial report from: 04/23/2018 16:10:45



Asbestos Chain of Custody

EMSL Order Number (Lab Use Only):

411803064

PHONE:
FAX:

Company Name : S&ME Inc.		EMSL Customer ID:	
Street: 620 Wando Park Blvd.		City: Mt. Pleasant	State/Province: SC
Zip/Postal Code: 29464	Country: USA	Telephone #: 843-884-0005	Fax #:
Report To (Name): James McMillan/Antonio Prioleau		Please Provide Results: <input type="checkbox"/> Fax <input checked="" type="checkbox"/> Email	
Email Address: JMcMillan@smeinc.com/aprioleau@smeinc.com		Purchase Order: 41569	
Project Name/Number: 4213-18-048/Fire Station #18		EMSL Project ID (Internal Use Only):	
U.S. State Samples Taken: sc		CT Samples: <input type="checkbox"/> Commercial/Taxable <input type="checkbox"/> Residential/Tax Exempt	

EMSL-Bill to: Same Different - If Bill to is Different note instructions in Comments**
Third Party Billing requires written authorization from third party

Turnaround Time (TAT) Options* - Please Check

3 Hour 6 Hour 24 Hour 48 Hour 72 Hour 96 Hour 1 Week 2 Week

*For TEM Air 3 hr through 6 hr, please call ahead to schedule. *There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

<p>PCM - Air <input type="checkbox"/> Check if samples are from NY</p> <p><input type="checkbox"/> NIOSH 7400</p> <p><input type="checkbox"/> w/ OSHA 8hr. TWA</p> <p>PLM - Bulk (reporting limit)</p> <p><input checked="" type="checkbox"/> PLM EPA 600/R-93/116 (<1%)</p> <p><input type="checkbox"/> PLM EPA NOB (<1%)</p> <p>Point Count</p> <p><input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%)</p> <p>Point Count w/Gravimetric</p> <p><input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%)</p> <p><input type="checkbox"/> NYS 198.1 (friable in NY)</p> <p><input type="checkbox"/> NYS 198.6 NOB (non-friable-NY)</p> <p><input type="checkbox"/> NYS 198.8 SOF-V</p> <p><input type="checkbox"/> NIOSH 9002 (<1%)</p>	<p>TEM - Air <input type="checkbox"/> 4-4.5hr TAT (AHERA only)</p> <p><input type="checkbox"/> AHERA 40 CFR, Part 763</p> <p><input type="checkbox"/> NIOSH 7402</p> <p><input type="checkbox"/> EPA Level II</p> <p><input type="checkbox"/> ISO 10312</p> <p>TEM - Bulk</p> <p><input type="checkbox"/> TEM EPA NOB</p> <p><input type="checkbox"/> NYS NOB 198.4 (non-friable-NY)</p> <p><input type="checkbox"/> Chatfield SOP</p> <p><input type="checkbox"/> TEM Mass Analysis-EPA 600 sec. 2.5</p> <p>TEM - Water: EPA 100.2</p> <p>Fibers >10µm <input type="checkbox"/> Waste <input type="checkbox"/> Drinking</p> <p>All Fiber Sizes <input type="checkbox"/> Waste <input type="checkbox"/> Drinking</p>	<p>TEM- Dust</p> <p><input type="checkbox"/> Microvac - ASTM D 5755</p> <p><input type="checkbox"/> Wipe - ASTM D6480</p> <p><input type="checkbox"/> Carpet Sonication (EPA 600/J-93/167)</p> <p>Soil/Rock/Vermiculite</p> <p><input type="checkbox"/> PLM EPA 600/R-93/116 with milling prep (<1%)</p> <p><input type="checkbox"/> PLM EPA 600/R-93/116 with milling prep (<0.25%)</p> <p><input type="checkbox"/> TEM EPA 600/R-93/116 with milling prep (<0.1%)</p> <p><input type="checkbox"/> TEM Qualitative via Filtration Prep</p> <p><input type="checkbox"/> TEM Qualitative via Drop Mount Prep</p> <p><input type="checkbox"/> Cincinnati Method EPA 600/R-04/004 - PLM/TEM (BC only)</p> <p>Other:</p> <p><input type="checkbox"/></p>
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Check For Positive Stop - Clearly Identify Homogenous Group Filter Pore Size (Air Samples): 0.8µm 0.45µm

Samplers Name: Antonio Prioleau Samplers Signature: [Signature]

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
235-FP-04	Fireproofing	1	4/17/18 1130
235-FP-05	Fireproofing	1	
235-FT1-01M	Mastic (Analyze mastic only)	2	

Client Sample # (s): 235-FP-04 - 235-FT1-01M Total # of Samples: 3

Relinquished (Client): [Signature] Date: 4-17-18 Time: 1230

Received (Lab): [Signature] Date: 4/18/18 Time: 9:05am Fk

Comments/Special Instructions: *sample 235-FT1-01M - analyze mastic only please * 8102 7235 8870

Appendix V- Summary of XRF Readings



V.I.N. No.	Site	Floor	Side	Room	Structure	Component	Color	Substrate	Condition	Results	Action Level	Lead	Units
22									Shutter	Calibrate		1.6	mg/cm ²
23									Calibrate			1.1	mg/cm ²
24									Calibrate			1.3	mg/cm ²
25									Calibrate			1.1	mg/cm ²
26	Station #18	1	B	Break Room	Baseboard		Beige	Wood	Non-deteriorated	Negative	0.7	0	mg/cm ²
27	Station #18	1	D	Break Room	Wall		Beige	Drywall	Non-deteriorated	Negative	0.7	0	mg/cm ²
28	Station #18	1	A	Break Room	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
29	Station #18	1	A	Conference	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
30	Station #18	1	B	Conference	Wall		Beige	Drywall	Non-deteriorated	Negative	0.7	0	mg/cm ²
31	Station #18	1	D	Conference	Window	Sill	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
32	Station #18	1	A	Stairwell	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
33	Station #18	1	B	Stairwell	Wall		Beige	CMU	Non-deteriorated	Negative	0.7	0	mg/cm ²
34	Station #18	1	D	Corridor	Wall		Beige	Drywall	Non-deteriorated	Negative	0.7	0	mg/cm ²
35	Station #18	1	A	Men's Room	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
36	Station #18	1	D	Men's Room	Wall		Beige	Ceramic	Non-deteriorated	Negative	0.7	0.05	mg/cm ²
37	Station #18	1	D	Men's Room	Wall		Blue	Ceramic	Non-deteriorated	Negative	0.7	0.05	mg/cm ²
38	Station #18	1	D	Men's Room	Wall		Brown	Ceramic	Non-deteriorated	Negative	0.7	0.1	mg/cm ²
39	Station #18	1	B	Men's Room	Floor		Blue	Ceramic	Non-deteriorated	Negative	0.7	0.03	mg/cm ²
40	Station #18	1	C	Men's Room	Sink		White	Porcelain	Non-deteriorated	Negative	0.7	0.07	mg/cm ²
41	Station #18	1	A	Utility	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
42	Station #18	1	D	Corridor	Baseboard		Beige	Wood	Non-deteriorated	Negative	0.7	0	mg/cm ²
43	Station #18	1	A	City Office	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
44	Station #18	1	A	Bay	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
45	Station #18	1	A	Bay	Door		Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
46	Station #18	1	B	Bay	Wall		Beige	CMU	Non-deteriorated	Negative	0.7	0	mg/cm ²

Summary of XRF Spectrum Lead Analyzer Readings
 City of Charleston - Fire Station # 18
 235 Seven Farms Drive
 Charleston, South Carolina

S&ME, Inc. 2413-18-048
 Date of Testing: April 9, 2018

Station #	Area	Room	Structure	Component	Color	Substrate	Condition	Results	Level	Units	
47	Station #18	1	C	Bay	Door	Red	Metal	Non-deteriorated	Null	0	mg/cm ²
48	Station #18	1	C	Bay	Door	Red	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
49	Station #18	1	A	Bay	Door	Red	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
50	Station #18	1	D	Bay	Wall	Beige	CMU	Non-deteriorated	Negative	0.7	mg/cm ²
51	Station #18	1	A	Utility	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
52	Station #18	1	A	Utility	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
53	Station #18	1	B	Utility	Wall	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
54	Station #18	1	B	Bay	Sink	White	Porcelain	Non-deteriorated	Negative	0.7	mg/cm ²
55	Station #18	1	A	Gear Room	Door	Grey	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
56	Station #18	1	A	Gear Room	Door	Grey	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
57	Station #18	1	A	Tank Storage	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
58	Station #18	1	A	Tank Storage	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
59	Station #18	1	A	Stairwell	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
60	Station #18	1	A	Stairwell	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
61	Station #18	1	A	Watch Room	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
62	Station #18	1	A	Watch Room	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
63	Station #18	1	B	Watch Room	Wall	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
64	Station #18	1	C	Bay	Door	Beige	CMU	Non-deteriorated	Negative	0.7	mg/cm ²
65	Station #18	1	C	Bay	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
66	Station #18	1	C	Bay	Door	Beige	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
67	Station #18	1	C	Stairwell	Stairs	Red	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
68	Station #18	1	C	Stairwell	Stairs	Red	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
69	Station #18	2	C	Stairwell	Stairs	Black	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
70	Station #18	2	C	Stairwell	Stairs	Black	Metal	Non-deteriorated	Negative	0.7	mg/cm ²
71	Station #18	2	C	Stairwell	Stairs	Silver	Metal	Non-deteriorated	Null	0.7	mg/cm ²
					Tread	Silver	Metal	Non-deteriorated	Null	0.7	mg/cm ²
					Tread	Silver	Metal	Non-deteriorated	Null	0.7	mg/cm ²





MLA No.	Site	Floor	Side	Room	Structure	Component	Color	Substrate	Condition	Results	Action Level	Lead	Units
72	Station #18	2	C	Stairwell	Stairs	Tread	Silver	Metal	Non-deteriorated	Null	0.7	0.01	mg/cm ²
73	Station #18	2	C	Stairwell	Stairs	Tread	Silver	Metal	Non-deteriorated	Null	0.7	0.01	mg/cm ²
74	Station #18	2	C	Stairwell	Stairs	Tread	Silver	Metal	Non-deteriorated	Null	0.7	0.01	mg/cm ²
75	Station #18	2	C	Stairwell	Stairs	Tread	Silver	Metal	Non-deteriorated	Null	0.7	0.01	mg/cm ²
76	Station #18	2	C	Corridor	Window	Casing	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
77	Station #18	2	B	Corridor	Wall		Beige	Drywall	Non-deteriorated	Negative	0.7	0	mg/cm ²
78	Station #18	2	A	Corridor	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
79	Station #18	2	B	Corridor	Wall		Beige	CMU	Non-deteriorated	Negative	0.7	0	mg/cm ²
80	Station #18	2	D	Corridor	Wall		Tan	Drywall	Non-deteriorated	Negative	0.7	0	mg/cm ²
81	Station #18	2	A	Utility	Door	Casing	Beige	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
82	Station #18	2	A	Utility	Wall		Grey	Drywall	Non-deteriorated	Null	0.7	0	mg/cm ²
83	Station #18	2	A	Utility	Wall		Grey	Drywall	Non-deteriorated	Negative	0.7	0	mg/cm ²
84	Station #18	2	D	Utility	Ladder		Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
85	Station #18	2	A	Utility	Stairs	Rail	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
86	Station #18	2	A	Utility	Stairs	Rail	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
87	Station #18	2	A	Utility	Stairs	Post	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
88	Station #18	1	C	Exterior	Door		Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
89	Station #18	1	C	Exterior	Window	Casing	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
90	Station #18	1	C	Exterior	Door	Casing	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
91	Station #18	1	C	Exterior	Door		Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
92	Station #18	1	C	Exterior	Fence		Red	Metal	Non-deteriorated	Negative	0.7	0.01	mg/cm ²
93	Station #18	1	C	Exterior	Bollard		Yellow	Concrete	Non-deteriorated	Negative	0.7	0	mg/cm ²
94	Station #18	1	C	Exterior	Bollard		Yellow	Concrete	Non-deteriorated	Negative	0.7	0	mg/cm ²
95	Station #18	1	C	Exterior	Bollard		Yellow	Concrete	Non-deteriorated	Negative	0.7	0	mg/cm ²
96	Station #18	1	A	Exterior	Beam		Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²
97	Station #18	1	A	Exterior	Door	Casing	Red	Metal	Non-deteriorated	Negative	0.7	0	mg/cm ²



SLN No.	Site	Floor	Side	Room	Structure	Component	Color	Substrate	Condition	Results	Action Level	Lead	Units
98									Calibrate			1.2	mg/cm ²
99									Calibrate			1	mg/cm ²
100									Calibrate			1.1	mg/cm ²

mg/cm² = milligram per square centimeter

SCDHEC requires special disposal for paint containing lead > 0.7 mg/cm²

OSHA does not recognize a concentration of lead for definition purposes, only the airborne concentration a worker is exposed.

Lead = Lead result meeting or exceeding SCDHEC disposal level of 0.7 mg/cm²

**SECTION 00 52 00
AGREEMENT FORM**

PART 1 GENERAL

1.01 FORM OF AGREEMENT

1.02 THE AGREEMENT FORM AIA A105 – 2017

**DRAFT STANDARD SHORT FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR
IS ATTACHED FOLLOWING THIS PAGE.**

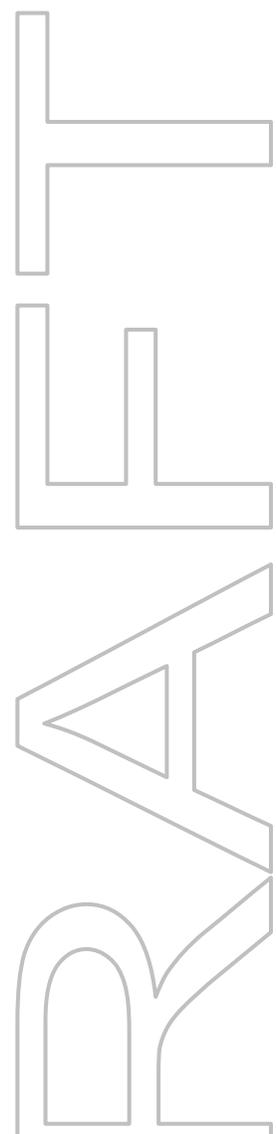
PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF AGREEMENT FORM

TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS**
- 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION**
- 3 CONTRACT SUM**
- 4 PAYMENTS**
- 5 INSURANCE**
- 6 GENERAL PROVISIONS**
- 7 OWNER**
- 8 CONTRACTOR**
- 9 ARCHITECT**
- 10 CHANGES IN THE WORK**
- 11 TIME**
- 12 PAYMENTS AND COMPLETION**
- 13 PROTECTION OF PERSONS AND PROPERTY**
- 14 CORRECTION OF WORK**
- 15 MISCELLANEOUS PROVISIONS**
- 16 TERMINATION OF THE CONTRACT**
- 17 OTHER TERMS AND CONDITIONS**



ARTICLE 1 THE CONTRACT DOCUMENTS

The Contractor shall complete the Work described in the Contract Documents for the Project. The Contract Documents consist of

- .1 this Agreement signed by the Owner and Contractor;
- .2 the drawings and specifications prepared by the Architect, dated [redacted], and enumerated as follows:

Drawings:

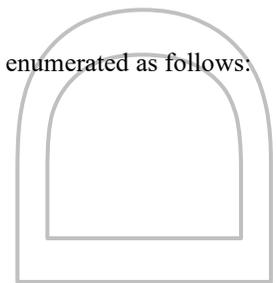
Number	Title	Date
---------------	--------------	-------------

[redacted]

Specifications:

Section	Title	Pages
----------------	--------------	--------------

[redacted]



- .3 addenda prepared by the Architect as follows:

Number

Date

Pages

- .4 written orders for changes in the Work, pursuant to Article 10, issued after execution of this Agreement; and
- .5 other documents, if any, identified as follows:

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The Contract Time is the number of calendar days available to the Contractor to substantially complete the Work.

§ 2.2 Date of Commencement:

Unless otherwise set forth below, the date of commencement shall be the date of this Agreement.

(Insert the date of commencement if other than the date of this Agreement.)

§ 2.3 Substantial Completion:

Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion, as defined in Section 12.5, of the entire Work:

(Check the appropriate box and complete the necessary information.)

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

[] By the following date:

ARTICLE 3 CONTRACT SUM

§ 3.1 The Contract Sum shall include all items and services necessary for the proper execution and completion of the Work. Subject to additions and deductions in accordance with Article 10, the Contract Sum is:

(\$)

§ 3.2 For purposes of payment, the Contract Sum includes the following values related to portions of the Work:

(Itemize the Contract Sum among the major portions of the Work.)

Portion of the Work

Value

§ 3.3 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and hereby accepted by the Owner:

(Identify the accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

§ 3.4 Allowances, if any, included in the Contract Sum are as follows:

(Identify each allowance.)

Item

Price

§ 3.5 Unit prices, if any, are as follows:

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

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

ARTICLE 4 PAYMENTS

§ 4.1 Based on Contractor's Applications for Payment certified by the Architect, the Owner shall pay the Contractor, in accordance with Article 12, as follows:

(Insert below timing for payments and provisions for withholding retainage, if any.)

§ 4.2 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate below, or in the absence thereof, at the legal rate prevailing at the place of the Project.

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

_____ % _____

ARTICLE 5 INSURANCE AND BONDS

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

§5.1.2 The insurance shall protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 _____ Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 _____ Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 _____ Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 _____ Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person;
- .5 _____ Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 _____ Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of any motor vehicle;
- .7 _____ Claims for bodily injury or property damage arising out of completed operations; and
- .8 _____ Claims involving contractual liability insurance applicable to the Contractor's indemnity obligations under Section 3.18;
- .9 _____ Claims or loss excluded under a prior work endorsement or other similar exclusionary language;
- .10 _____ Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language;
- .11 _____ Claims related to roofing, if the Work involves roofing;
- .12 _____ Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces;
- .13 _____ Claims related to earth subsidence or movement, where the Work involves such hazards; and
- .14 _____ Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§5.1.2 The insurance required by Section 5 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverage shall be written on an occurrence basis and shall be maintained without interruption from date of commencement of the Work through substantial completion and for a period of eight (8) years after substantial completion of the Project. The minimum limits of liability for the following types of insurance are:

<u>.1</u>	<u>Workers' Compensation, including:</u>	<u>Limit</u>
	<u>a. Workers' Compensation Insurance-</u>	<u>Statutory</u>
	<u>b. Employers' Liability-Each Accident-</u>	<u>\$100,000</u>
	<u>Disease-</u>	<u>\$500,000</u>
	<u>Disease-Each Employee-</u>	<u>\$100,000</u>
<u>.2</u>	<u>Commercial General Liability, including,</u>	<u>Limits</u>
	<u>a. General Aggregate</u>	<u>\$2,000,000</u>
	<u>b. Products-Completed</u>	
	<u>Operations-Aggregate</u>	<u>\$1,000,000</u>
	<u>c. Personal and Advertising Injury</u>	<u>\$1,000,000</u>
	<u>d. Each Occurrence</u>	<u>\$1,000,000</u>
	<u>e. Fire Damage (any one fire)</u>	<u>\$ 50,000</u>
	<u>f. Medical Expense (any one person)</u>	<u>\$ 5,000</u>
<u>.3</u>	<u>Business Automobile Liability, including all Owner, Non-Owned and Hired:</u>	
	<u>Combined Single Limit:</u>	<u>\$2,000,000</u>
	<u>OR</u>	
	<u>Bodily Injury & Property Damage (each)</u>	<u>\$1,000,000</u>
<u>.4</u>	<u>Umbrella coverage (follow form)</u>	<u>\$5,000,000</u>
<u>.5</u>	<u>Builder's Risk, (fire and extended coverage), construction, as well as stored materials</u>	<u>Full cash value of completed for all work in place and materials stored on or off-site or in transit</u>

§5.1.3 In addition to Contractual Liability including the indemnification provision, Bodily Injury, and Property Damage coverage under both Comprehensive General and Comprehensive Automobile forms, shall include "occurrence" basis wording, which means an event, or continuous or repeated exposure to condition which unexpectedly causes injury or damage during the policy period. The Owner shall be an additional insured on the Contractor's comprehensive general liability policy. Additional insured endorsements CG 20 10 07 04 and CG 20 37 07 04 or endorsements providing the same coverage shall be obtained to satisfy the additional insured requirements. The additional insured coverage shall be a Primary and Non-Contributory policy. Contractor shall maintain all required coverages for at least 8 years after substantial completion of the Project.

§5.1.4 Contractor shall either (a) require each of its Subcontractors to procure and maintain during the life of its Subcontract, Subcontractor Comprehensive General Liability, Automobile Liability, and Property Damage Liability Insurance of the type and in the same amounts as specified in this Subparagraph, or (b) insure the activities of its Subcontractors in its own policy.

§5.1.5 Certificates of insurance or AIA Document G705, latest edition, shall be filed with the Architect and Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. Certificates must be fully completed. Incomplete certificates shall not be accepted and commencement of work shall not start until a fully completed certificate is provided. Any delays due to incomplete certificates shall not warrant an extension of Contract Time. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be

submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the time required by the Contract Documents Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

~~§5.1.6 If excavation is required, Contractor shall obtain underground hazard coverage in addition to other coverages required. The Contractor shall maintain the following types and limits of insurance until the expiration of the period for correction of Work as set forth in Section 14.2, subject to the terms and conditions set forth in this Section 5.1:~~

~~§5.1.1 Commercial General Liability insurance for the Project, written on an occurrence form, with policy limits of not less than _____ (\$ _____) each occurrence, _____ (\$ _____) general aggregate, and _____ (\$ _____) aggregate for products-completed operations hazard.~~

~~§5.1.2 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than _____ (\$ _____) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance, and use of those motor vehicles along with any other statutorily required automobile coverage.~~

~~§5.1.3 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided that such primary and excess or umbrella insurance policies result in the same or greater coverage as those required under Section 5.1.1 and 5.1.2, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require exhaustion of the underlying limits only through the actual payment by the underlying insurers.~~

~~§5.1.4 Workers' Compensation at statutory limits.~~

~~§5.1.5 Employers' Liability with policy limits not less than _____ (\$ _____) each accident, _____ (\$ _____) each employee, and _____ (\$ _____) policy limit.~~

~~§5.1.6 The Contractor shall provide builder's risk insurance to cover the total value of the entire Project on a replacement cost basis.~~

§ 5.1.7 Other Insurance Provided by the Contractor

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits
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§ 5.2 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance and shall provide property insurance to cover the value of the Owner's property. The Contractor is entitled to receive an increase in the Contract Sum equal to the insurance proceeds related to a loss for damage to the Work covered by the Owner's property insurance.

§ 5.3 Performance and Payment Bonds.

§5.3.1 The Contractor shall provide Performance and Labor and Material Payment Bonds, each in the amount of 100% of the Contract Sum.

- .1 The Surety shall have, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty". In addition, the Surety shall have a minimum "Best Financial Strength Category" of "Class V" and in no case less than five (5) times the contract amount.
- .2 The Performance Bond and the Payment Bond shall be made payable to the Owner.
- .3 The Performance and Labor Material Payment Bonds shall:
 - (1) be issued by a surety company licensed to do business in South Carolina; and,
 - (2) be accompanied by a current power of attorney and certified by the attorney-in-fact who executes the bond on the behalf of the surety company; and,
 - (3) remain in effect for a period of time not less than two (2) years following the date of Substantial

Completion; and

(4) display the Surety's Bond Number. A rider including the following provisions shall be attached to each Bond stating that:

(a) The Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Any addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder, and notice to the Surety of such matters is hereby waived.

(b) The Surety agrees that it is obligated under the bonds to any successor, grantee, or assignee of the Owner.

(5) Notwithstanding the foregoing, any bonds required by this Contract shall meet the requirements of the SC Code of Laws, as amended.

§5.3.2 The Contractor shall furnish the required bonds to the Owner before execution of the Contract.

§5.3.3 The Owner may, in the Owner's sole discretion, inform the Surety of the progress of the Work and obtain consents as necessary to protect the Owner's rights, interest, privileges, and benefits under and pursuant to any bond issued in connection with the Work.

~~The Contractor shall obtain an endorsement to its Commercial General Liability insurance policy to provide coverage for the Contractor's obligations under Section 8.12.~~

~~§ 5.4 Prior to commencement of the Work, each party shall provide certificates of insurance showing their respective coverages.~~

~~§ 5.5 Unless specifically precluded by the Owner's property insurance policy, the Owner and Contractor waive all rights against (1) each other and any of their subcontractors, suppliers, agents, and employees, each of the other; and (2) the Architect, Architect's consultants, and any of their agents and employees, for damages caused by fire or other causes of loss to the extent those losses are covered by property insurance or other insurance applicable to the Project, except such rights as they have to the proceeds of such insurance.~~

ARTICLE 6 GENERAL PROVISIONS

§ 6.1 The Contract

The Contract represents the entire and integrated agreement between the parties and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a written modification in accordance with Article 10.

§ 6.2 The Work

The term "Work" means the construction and services required by the Contract Documents, and includes all other labor, materials, equipment, and services provided, or to be provided, by the Contractor to fulfill the Contractor's obligations.

§ 6.3 Intent

The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all.

§ 6.4 Ownership and Use of Architect's Drawings, Specifications and Other Documents

Documents prepared by the Architect are instruments of the Architect's service for use solely with respect to this Project. The Architect shall retain all common law, statutory, and other reserved rights, including the copyright, as authorized by Architects agreement with Owner. The Contractor, subcontractors, sub-subcontractors, and suppliers are authorized to use and reproduce the instruments of service solely and exclusively for execution of the Work. The instruments of service may not be used for other Projects or for additions to this Project outside the scope of the Work without the specific written consent of the Architect and Owner.

§ 6.5 Electronic Notice

Written notice under this Agreement may be given by one party to the other by email as set forth below.

(Insert requirements for delivering written notice by email such as name, title, and email address of the recipient, and whether and how the system will be required to generate a read receipt for the transmission.)

ARTICLE 7 OWNER

§ 7.1 Information and Services Required of the Owner

§ 7.1.1 If requested by the Contractor, the Owner shall furnish all necessary surveys and a legal description of the site.

§ 7.1.2 Except for permits and fees under Section 8.7.1 that are the responsibility of the Contractor, the Owner shall obtain and pay for other necessary approvals, easements, assessments, and charges. Contractor shall notify Owner in writing of all approvals, easements, assessments, and charges required for construction or occupancy of permanent structures of which the Contractor has knowledge. Written notice to Owner is a condition precedent to Contractor's right to costs or time extensions for Owner's failure to meet this obligation.

~~§ 7.1.3 Prior to commencement of the Work, at the written request of the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence.~~ Reserved..

§ 7.2 Owner's Right to Stop the Work

If the Contractor fails to correct Work which is not in accordance with the Contract Documents, the Owner may direct the Contractor in writing to stop the Work until the correction is made.

§ 7.3 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies, correct such deficiencies. In such case, the Architect may withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the cost of correction, provided the actions of the Owner and amounts charged to the Contractor were approved by the Architect.

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

§ 7.4.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project.

§ 7.4.2 The Contractor shall coordinate and cooperate with the Owner's own forces and separate contractors employed by the Owner.

ARTICLE 8 CONTRACTOR

§ 8.1 Review of Contract Documents and Field Conditions by Contractor

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

§ 8.1.2 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner. Before commencing activities, the Contractor shall (1) take field measurements and verify field conditions; (2) carefully compare this and other information known to the Contractor with the Contract Documents; and (3) promptly report errors, inconsistencies, or omissions discovered to the Architect.

§ 8.2 Contractor's Construction Schedule

The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work.

§ 8.3 Supervision and Construction Procedures

§ 8.3.1 The Contractor shall supervise and direct the Work using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work.

§ 8.3.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner, through the Architect, the names of subcontractors or suppliers for each portion of the Work. The Contractor shall not contract with any subcontractor or supplier to whom the Owner or Architect have made a timely and reasonable objection.

§ 8.4 Labor and Materials

§ 8.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work.

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

§ 8.5 Warranty

The Contractor warrants to the Owner and Architect that: (1) materials and equipment furnished under the Contract will be new and of good quality unless otherwise required or permitted by the Contract Documents; (2) the Work will be free from defects not inherent in the quality required or permitted; and (3) the Work will conform to the requirements of the Contract Documents. Any material or equipment warranties required by the Contract Documents shall be issued in the name of the Owner, or ~~shall be transferable~~ assigned to the Owner, and shall commence in accordance with Section 12.5.

§ 8.6 Taxes

The Contractor shall pay sales, consumer, use, and similar taxes that are legally required when the Contract is executed. [The Contractor's attention is directed to Title 12, Chapter 8, Code of Laws of South Carolina 1976, as amended, concerning withholding tax for non-residents, employees, contractors and subcontractors.](#)

§ 8.7 Permits, Fees and Notices

§ 8.7.1 The Contractor shall obtain and pay for the building permit and other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work.

§ 8.7.2 The Contractor shall comply with and give notices required by agencies having jurisdiction over the Work. If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs. The Contractor shall promptly notify the Architect in writing of any known inconsistencies in the Contract Documents with such governmental laws, rules, and regulations.

§ 8.8 Submittals

The Contractor shall promptly review, approve in writing, and submit to the Architect shop drawings, product data, samples, and similar submittals required by the Contract Documents. Shop drawings, product data, samples, and similar submittals are not Contract Documents.

§ 8.9 Use of Site

The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits, the Contract Documents, and the Owner.

§ 8.10 Cutting and Patching

The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. [Photos showing existing conditions shall be taken to verify conditions prior to work and provided to Owner.](#)

§ 8.11 Cleaning Up

The Contractor shall keep the premises and surrounding area free from accumulation of debris and trash related to the Work. The site shall be cleaned as necessary and no less than daily. At the completion of the Work, the Contractor shall remove its tools, construction equipment, machinery, and surplus material; and shall properly dispose of waste materials.

§ 8.12 Indemnification

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

ARTICLE 9 ARCHITECT

§ 9.1 The Architect will provide administration of the Contract as described in the Contract Documents. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 9.2 The Architect will visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the Work.

§ 9.3 The Architect will not have control over or charge of, and will not be responsible for, construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility. The Architect will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

§ 9.4 Based on the Architect's observations and evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor.

§ 9.5 The Architect has authority to reject Work that does not conform to the Contract Documents.

§ 9.6 The Architect will promptly review and approve or take appropriate action upon Contractor's submittals, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 9.7 On written request from either the Owner or Contractor, the Architect will promptly interpret and decide matters concerning performance under, and requirements of, the Contract Documents.

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

§ 9.9 The Architect's duties, responsibilities, and limits of authority as described in the Contract Documents shall not be changed without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

ARTICLE 10 CHANGES IN THE WORK

§ 10.1 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract, consisting of additions, deletions or other revisions, and the Contract Sum and Contract Time shall be adjusted accordingly, in writing. If the Owner and Contractor cannot agree to a change in the Contract Sum, the Owner shall pay the Contractor its actual cost plus reasonable overhead and profit.

§ 10.2 The Architect may authorize or order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. Such authorization or order shall be in writing and shall be binding on the Owner and Contractor. The Contractor shall proceed with such minor

changes promptly. Change Order and Construction Change Directives that involve and adjustment to the Contract Sum or an extension of the Contract Time are effective only after written approval by the Owner.

§ 10.3 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and Contract Time shall be subject to equitable adjustment.

§10.4 Any Contractor/Subcontractor performing work under a change order must be able to segment and monitor material and labor costs for Change Orders separately from the work performed under the original contract and deemed part of the Cost of the Work.

§10.5 Contractor's signature on a change order is a full, final and complete waiver of any and all claims, demands, impact costs, damages or causes of action arising out of or related to the change orders.

ARTICLE 11 TIME

§ 11.1 Time limits stated in the Contract Documents are of the essence of the Contract.

§ 11.2 Delays and Extensions of Time shall be documented and submitted to the Architect and Owner in writing no later than twenty-one (21) calendar days after the first observance or encounter of the condition. Completion time stipulated under other sections of the Contract Documents may be extended by Change Order or Construction Change Directive to provide one (1) additional work day for each full work day that the Contractor is prevented from working by reason of one or more of the following causes:

1. Unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not limited to catastrophes, acts of God, changes ordered in the Work, act or neglect of Owner or Architect or a Separate Contractor, unusual delay in deliveries, unavoidable casualties, epidemics, quarantine restrictions, strikes, or freight embargos;
2. An unusual amount of severe weather to such an extent as to be definitely abnormal and beyond conditions that may be reasonably anticipated. For the purpose of this Contract, a total of five (5) working days per calendar month shall be anticipated as "normally bad or severe weather," and such time will not be considered justification for an extension of time. Weather related time extensions shall be determined on a monthly basis upon proper notification. The five (5) days each month shall not be aggregated for the entire project for the purpose of determining weather related time extensions.
3. Stoppage of work ordered by Owner or Architect for reasons over which Contractor has no control. If the Contractor is delayed at any time in progress of the Work by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, or other causes beyond the Contractor's control, the Contract Time shall be subject to equitable adjustment.

§ 11.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the responsible party.

ARTICLE 12 PAYMENTS AND COMPLETION

§ 12.1 Contract Sum

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

§ 12.2 Applications for Payment

§ 12.2.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for Work completed in accordance with the values stated in this Agreement. The Application shall be supported by data substantiating the Contractor's right to payment as the Owner or Architect may reasonably require, such as evidence of payments made to, and waivers of liens from, subcontractors and suppliers. Payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment stored, and

protected from damage, off the site at a location agreed upon in writing.

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

§12.2.3 Retainage.

.1 Until the Work is fifty percent (50%) complete, the Architect shall authorize, with Concurrence of the Owner, ninety percent (90%) of the amount due to the Contractor on account of progress payments. At the time the Work is fifty percent (50%) complete and thereafter, the Architect with the Concurrence of the Owner, may authorize ninety-five percent (95%) of the amount due to the Contractor on account of progress payments. Reduction of retainage shall be at the sole discretion of the Owner. Retainage shall continue until Final Completion and Final Payment.

.2 The Owner may elect to reinstate the full Contract retainage if the manner of completion of the Work and its progress do not remain satisfactory to the Architect or if the Surety withholds or revokes its consent, or for other good and sufficient reasons.

.3 The Owner will not consider a reduction of retainage below five percent (5%) of the total contract amount until all record drawings, guarantees, and operation and maintenance manuals have been submitted to the Architect as required by the specifications and are found to be acceptable by the Architect.

§ 12.3 Certificates for Payment

The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in part; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole. If certification or notification is not made within such seven day period, the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time and the Contract Sum shall be equitably adjusted due to the delay.

§ 12.4 Progress Payments

§ 12.4.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner provided in the Contract Documents.

§ 12.4.2 The Contractor shall promptly pay each subcontractor and supplier, upon receipt of payment from the Owner, an amount determined in accordance with the terms of the applicable subcontracts and purchase orders.

§ 12.4.3 Neither the Owner nor the Architect shall have responsibility for payments to a subcontractor or supplier.

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

§12.4.5 After substantial completion, Contractor may submit progress pay applications at 30, 60, and 90 days after substantial completion. After 90 days, no other progress pay applications will be accepted and no further payment will be made until Final Payment.

§ 12.5 Substantial Completion

§ 12.5.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use and all certificates of occupancy and all other permits or approvals necessary for the Owner to occupy and utilize the Project have been issued.

§ 12.5.2 When the Contractor believes that the Work or designated portion thereof is substantially complete, it will notify the Architect and the Architect will make an inspection to determine whether the Work is substantially complete. When the Architect determines that the Work is substantially complete, the Architect shall prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, establish the responsibilities of the Owner and Contractor, and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 12.6 Final Completion and Final Payment

§ 12.6.1 Upon receipt of a final Application for Payment, the Architect will inspect the Work. When the Architect finds the Work acceptable and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment.

§ 12.6.2 Final payment shall not become due until the Contractor submits to the Architect releases and waivers of liens, and data establishing payment or satisfaction of obligations, such as receipts, claims, security interests, or encumbrances arising out of the Contract. Additionally, final payment shall not become due until:

- a. the final punch list has been completed and a copy of the list submitted showing the disposition of each item,
- b. a final inspection has been conducted and all items are completed,
- c. a Certificate of Substantial Completion has been properly approved and filed,
- d. an affidavit has been provided that all payrolls, bills for materials and equipment, and other indebtedness conducted with the work for which the Owner or its property might in any way be responsible, have been paid for otherwise satisfied,
- e. the consent of the Surety, if any, to final payment is provided,
- f. Completion of Owner's audit rights. Owner's audit, if the Owner chooses to conduct one, must be completed within 30 days after all required documentation is received by Owner,
- g. All warranty and manufacturing documentation has been transferred to Owner.

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

ARTICLE 13 PROTECTION OF PERSONS AND PROPERTY

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs, including all those required by law in connection with performance of the Contract. The Contractor shall take reasonable precautions to prevent damage, injury, or loss to employees on the Work and other persons who may be affected thereby, the Work and materials and equipment to be incorporated therein, and other property at the site or adjacent thereto. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, or by anyone for whose acts the Contractor may be liable.

ARTICLE 14 CORRECTION OF WORK

§ 14.1 The Contractor shall promptly correct Work rejected by the Architect as failing to conform to the requirements of the Contract Documents. The Contractor shall bear the cost of correcting such rejected Work, including the costs of uncovering, replacement, and additional testing.

§ 14.2 In addition to the Contractor's other obligations including warranties under the Contract, the Contractor shall, for a period of one year after Substantial Completion, correct work not conforming to the requirements of the Contract Documents.

§ 14.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 7.3.

ARTICLE 15 MISCELLANEOUS PROVISIONS

§ 15.1 Assignment of Contract

Neither party to the Contract shall assign the Contract as a whole without written consent of the other.

§ 15.2 Tests and Inspections

§ 15.2.1 At the appropriate times, the Contractor shall arrange and bear cost of tests, inspections, and approvals of portions of the Work required by the Contract Documents or by laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities.

§ 15.2.2 If the Architect requires additional testing, the Contractor shall perform those tests.

§ 15.2.3 The Owner shall bear cost of tests, inspections, or approvals that do not become requirements until after the Contract is executed. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 15.3 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules.

ARTICLE 16 TERMINATION OF THE CONTRACT

§ 16.1 Termination by the Contractor

If the Work is stopped under Section 12.3 for a period of 14-30 consecutive days through no fault of the Contractor, the Contractor may, upon seven additional days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed including reasonable overhead and profit, and costs incurred by reason of such termination.

§ 16.2 Termination by the Owner for Cause

§ 16.2.1 The Owner may terminate the Contract if the Contractor

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

§ 16.2.2 When any of the above reasons exist, the Owner, ~~after consultation with the Architect,~~ may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may

- .1 take possession of the site and of all materials thereon owned by the Contractor, and
- .2 finish the Work by whatever reasonable method the Owner may deem expedient.

§ 16.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 16.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 16.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The Owner shall not be required to proceed in completing the work at the lowest possible cost. The cost of finishing the work may include, but not limited to: (1) cost of labor and material, (2) additional Architectural services, (3) costs of advertising or bidding, (4) attorneys' fees, (5) administrative costs, and (6) all other costs or expenses directly or indirectly relating to the termination. This obligation for payment shall survive termination of the Contract.

§ 16.3 Termination by the Owner for Convenience

The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. The Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed. Termination by the Owner for convenience does not relieve the Contractor from responsibility for liquidated damages that may have accrued prior to the date of termination.

ARTICLE 17 OTHER TERMS AND CONDITIONS

(Insert any other terms or conditions below.)



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

(If required by law, insert cancellation period, disclosures or other warning statements above the signatures.)



OWNER *(Signature)*

(Printed name and title)

CONTRACTOR *(Signature)*

(Printed name and title)
LICENSE NO.:
JURISDICTION:



SECTION 011000 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. This Section includes the following:
1. Work covered by the Contract Documents.
 2. Work schedule.
 3. Use of premises.
 4. Concurrent work by public utilities.
 5. Owner's occupancy requirements.
 6. Work restrictions.
 7. Diverse supplier requirements
 8. Specification formats and conventions.
 9. Regulatory Requirements

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1. Project Identification: PRJ_Fire Station #18 Renovations
Project address is: 235 Seven Farms Drive, Charleston SC 29492.
2. Summary of Work: The project scope is phased interior demolitions and renovations to the existing two-story fire station. The Fire Station shall remain occupied and operational during construction. The Contractor is responsible for moving out , storing, protecting and reinstalling all existing furniture in the areas of work.
3. Owner: City of Charleston Department of Parks
Capital Projects Division
823 Meeting Street
Charleston, SC 29403
4. Owner's Representative: Gable D. Stubbs, AIA
Senior Project Manager, Facilities and Capital Projects
(843) 608-5066
stubbsg@charleston-sc.gov
5. Architect: Shawn Melin, AIA
GBA Architecture
493 King Street, Suite 100
Charleston, South Carolina 29403
mellin@gba-arch.com

1.4 WORK SCHEDULE

- A. The work shall be completed in phases (refer to drawings G113 and G114) and shall be Substantially Complete, such that the improvements have received approval and acceptance for operation and maintenance by the authorities having jurisdiction, within the number of

calendar days indicated on the Bid Form plus only those authorized time extensions as allowed by the General and Supplementary Conditions, after the Notice to Proceed.

- B. Final Completion shall be achieved within fourteen consecutive calendar days from the execution date of the "Certificate of Substantial Completion."
- C. Contractor also agrees to pay as liquidated damages the sum dollars listed in the contract documents for each consecutive calendar day thereafter that the work fails to reach completion within the time allowed.
- D. Before commencing work, submit a schedule showing the sequence, commencement, and completion dates for the work.

1.5 USE OF PREMISES

- A. General: Contractor shall have full use of areas of work per phases for construction operations, including use of designated portions of the project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of project.
- B. Construction Laydown Area: Contractor shall coordinate with the Owner regarding the location of the construction laydown area, in order to provide temporary storage of equipment and supplies for the duration of the project. This area shall be maintained with the proper fencing, signage, locking devices, and any other applicable safety standards to prevent injury and hazards, and protect the Owner, construction personnel, and the general public.
- C. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of project site beyond areas in which the work is indicated. Do not obstruct roadways, sidewalks or other public ways without permission.
- D. Emergency Exits: During construction, keep all emergency exits required by code open during construction duration. Provide temporary exit signs as required.
- E. Utility/Systems Outages or Shutdown: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Provide notification to Owner and authorities having jurisdiction 7 days prior to any intended utility/Systems outages or shut down. Including life safety systems but not limited to fire sprinklers and alarm systems.
 - 2. Do not proceed with utility interruptions without written permission.
 - 3. In the event of any unintended utility/systems outages notify the Owner immediately. Point of Contact for Utility/Systems Outages or Shutdown:

Michael J. Kennedy
Deputy Director – Facilities
(843) 276-1344
kennedym@charleston-sc.gov
- F. Environmentally Sensitive Areas: Encroachment into wetlands, buffers, and other environmentally sensitive areas is prohibited except in areas where specifically indicated and permitted by authorities having jurisdiction.
- G. Tobacco and Control Substances: Use of tobacco or vaping products, alcoholic beverages, and other controlled substances on the project site are strictly prohibited.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to place into operation completed areas of the project, before Substantial Completion of the entire project, provided such operation does not interfere with completion of the work. Such operation shall not constitute acceptance of the total work.
1. The Architect/Engineer (A/E) will prepare a Certificate of Substantial Completion for each specific portion of the work to be placed into operation.
 2. Obtain acceptance for operation and maintenance from authorities having jurisdiction before designated area is placed into operation.
 3. Where applicable and before being placed into operation, designated improvements shall be fully operational and required tests and inspections shall be successfully completed.

1.7 WORK RESTRICTIONS

- A. On-Site Work Hours: Monday – Friday 7 am to 7 pm unless authorized previously by Owner.
1. Coordinate intended work schedule with the Owner at Pre-construction meeting and provide advanced notice of any changes to schedule during construction.
 2. Preparatory activities may begin up to 30 minutes early if they are not disruptive to adjacent property owners / residents.
- B. Noise: During all work hours, Contractor shall endeavor to keep noise levels to the minimum required for operations in progress.
1. Turn off or bring to idle machinery not in current use.
 2. Move maintenance and other portable operations to locations where disturbance of nearby property owners is less likely.
 3. Maintain equipment such that its noise level is not greater than typical for a given type.
 4. Where practical, use equipment of the minimum size and noise level for a given operation.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the project Manual to determine numbers and names of Sections in the Contract Documents.
 2. Division 01: Sections in Division 01 govern the execution of the work of all Sections in the Specifications.
- B. 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.9 REGULATORY REQUIREMENTS

A. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.

1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality or more restrictive requirement shall apply.
2. Submit copies of all permits and licenses, required by governing authorities having jurisdiction, to Owner and Engineer.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 ALLOWANCES

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 governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.

1.3 DEFINITIONS

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

1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise A/E of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At A/E's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by A/E from the designated supplier.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 ACTION SUBMITTALS

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

1.7 LUMP-SUM ALLOWANCES

- A. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site,

labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by A/E under allowance shall be included as part of the Contract Sum and not part of the allowance.

- B. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by A/E, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
 - 3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
 - 2. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 - 3. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.
- C. At the conclusion of the project, any un-used balances in the Allowances shall be returned to the Owner as a credit on the final pay application.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

1.1 EXAMINATION

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

1.2 PREPARATION

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

ALLOWANCES

with related work.

1.3 SCHEDULE OF ALLOWANCES

A. **Allowance No. 1: Section 08 71 00 – Door Hardware**

1. Include the stipulated sum of \$3,000 for purchase and delivery of Door Hardware. Storefront door hardware is not included in this allowance.
2. Use of this allowance will be through authorized Change Orders only.

B. **Allowance No. 2: Kitchen Appliances.**

1. Include the stipulated sum of \$12,000 for the costs associated with providing and installing kitchen appliances as shown on the plans.
2. Use of this allowance will be through authorized Change Orders only.

END OF SECTION 012100

SECTION 012500 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 after contract award. Refer to Instructions to Bidders for substitution requests during the bid process.
- B. Related Requirements:
 - 1. Section 016000 "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 and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 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. 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.
 - l. 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 seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (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 one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the work, not involving adjustment to the Contract Sum or the Contract Time, on the City's "Construction Change Directive" form or an equivalent document.

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. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within five (5) business days 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.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Engineer.
 - 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 Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 CHANGE ORDER PROCEDURES

- A. Upon Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on the City of Charleston's "Construction Change Order" form.
- B. For any adjustment to the Contract for which overhead and profit may be recovered, the Contractor agrees to charge and accept the following percentages of costs attributable to the change in the work as full payment for Overhead and Profit. The percentages shown shall be considered to include all indirect costs including, but not limited to field and office managers, supervisors and assistants, incidental job burdens, small tools, and general overhead allocations. "Commission" is defined as profit on work performed by others.
1. To the CONTRACTOR or Subcontractor on work performed by their own forces:
 - a. Overhead: 10%
 - b. Profit: 7%
 - c. Commission: 0%
 2. To the CONTRACTOR on work performed by its Subcontractors:
 - a. Overhead: 10%
 - b. Profit: 0%
 - c. Commission: 3%
 3. To a first tier Subcontractor on work performed by its Subcontractors:
 - a. Overhead: 10%
 - b. Profit: 0%
 - c. Commission: 3%
- C. All Change Order proposals shall be accompanied by a complete itemization of cost including labor, materials and subcontracts. Labor and materials shall be itemized. Where major cost items are subcontracts, they shall be itemized as well.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on the City of Charleston's "Construction Change Directive" form. 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 012600

SECTION 012900 PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Owner 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 the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Submit draft of AIA Document G703 Continuation Sheets or equivalent format.
 - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
 - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 5. Provide a separate line item in the Schedule of Values for each part of the work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
 - a. Include each Change Order or Construction Change Directive as a new line item on the Schedule of Values.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment, or an equivalent format.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 3. 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 of Payment.
- 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 3 signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from 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 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 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 waivers of lien on forms, executed in a manner 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. Submittals Schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. Initial progress report.
 8. Report of preconstruction conference.
 9. Certificates of insurance and insurance policies.
 10. Approved Traffic Control Plan
- I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the work claimed as substantially complete.
1. Include documentation supporting claim that the work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the work.

- J. Final Payment Application: 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on project including, but not limited to, the following:
 - 1. Electronic Documents Submittals.
 - 2. Coordination.
 - 3. Administrative and supervisory personnel.
 - 4. Project meetings.
 - 5. Requests for Information (RFIs).
 - 6. Number of copies of submittals.
 - 7. Submittal procedures.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 Electronic Document Submittals

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an internet-based submittal services that receives, logs and stores the documents, provides electronic stamping and signatures and notifies addresses via email.
 - 1. Beside submittals for review, information and closeout this procedure applies to request for information (RFIs), progress documentation, contract modification documents (i.e. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor correction of punchlist, and any other document and participant wishes to make part of the project record.
 - 2. It is the Contractor's responsibility to submit documents in PDF format.
 - 3. All other Specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

1.5 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where

- installation of one part of the work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- 1. Prepare similar memoranda for Owner and separate contractors if coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
- 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Startup and adjustment of systems.
 - 8. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
- 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

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

1.7 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 Engineer of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three (3) days of the meeting.
- B. Preconstruction Conference:

City of Charleston – Preconstruction Conference

1. Schedule a preconstruction conference before starting construction, at a time convenient to Owner and A/E. Hold the conference at project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
 - a. Attendees: Authorized representatives of Owner, A/E, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with project and authorized to conclude matters relating to the work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communication
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of Record Documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for disruptions and shutdowns.
 - r. Construction waste management and recycling.
 - s. Parking availability.
 - t. Office, work, and storage areas.
 - u. Equipment deliveries and priorities.
 - v. First aid.
 - w. Security.
 - x. Progress cleaning.
 - y. Working hours.
 3. Minutes: Record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at project site where required by individual Specification Sections and before each construction activity that requires coordination with other construction.
1. Attendees:
 - a. Contractor's project supervisor.
 - b. Installer.
 - c. Representative of authority have jurisdiction (where required by authority).
 - d. 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 (where necessary to assure proper installation).
 2. Advise Engineer of scheduled meeting dates and invite attendance.
 3. Agenda: Review progress of other construction activities and preparations for the particular

activity under consideration, including requirements for the following:

- a. The Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - 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. Requirements 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.
4. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 5. Reporting: Distribute minutes of the meeting to Engineer, each party present, and to parties who should have been present.
 6. 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 bi-weekly unless an alternate schedule is required due to project conditions. In no circumstance shall meetings be less frequent than monthly. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and A/E, 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 conference shall be familiar with project and authorized to conclude matters relating to the work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of project.

- a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 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 utilization.
 8. Temporary facilities and controls.
 9. Work hours.
 10. Hazards and risks.
 11. Progress cleaning.
 12. Quality and work standards.
 13. Requirements of authorities having jurisdiction.
 14. Status of correction of deficient items.
 15. Field observations.
 16. RFIs.
 17. Status of proposal requests.
 18. Pending changes.
 19. Status of Change Orders.
 20. Pending claims and disputes.
 21. Documentation of information for payment requests.
 22. Closeout Procedures (where applicable).
3. Minutes: Record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.8 REQUESTS FOR INFORMATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at project meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
 3. Ensure that RFI's are not frivolous by carefully reviewing Contract Documents to confirm that the required information is not overlooked. A/E reserves the right to request compensation by Contractor for time spent responding to repeated submittals of RFI's for

information clearly provided in the Contract Documents.

- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Engineer.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by the Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. RFI Forms: AIA Form G716 or equivalent format.
1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. A/E's Action: A/E will review each RFI, determine action required, and return it. Allow 5 working days for A/E's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Request of 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 A/E's actions on submittals.
 - g. Incomplete RFIs or RFIs with numerous errors.
 2. A/E's action may include a request for additional information, in which case A/E's time for response will start again.
 3. A/E's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify A/E in writing within 5 days of receipt of the RFI response.

- F. On receipt of A/E's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify A/E within 5 days if Contractor disagrees with response.
- G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log after each update.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 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. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the work, including the following:
 - 1. Startup Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Daily Construction Reports.
 - 4. Site Condition Reports.
 - 5. Special Reports.
 - 6. Submittals Schedule.

1.3 DEFINITIONS

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.

Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

Event: The starting or ending point of an activity.

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.

Milestone: A key or critical point in time for reference or measurement.

1.4 SUBMITTALS

- A. Format for Submittals: Submit required submittals in PDF file format.
- B. Startup Construction Schedule.
 - 1. Submittal of cost-loaded, startup construction schedule will not constitute approval of
- 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.
 - 2. TAB Completion
 - 3. Architects/Engineer punch walk through
 - 4. Any DHEC inspections (pre, overhead, or final required)
- D. Daily Construction Reports: Submit at weekly intervals.
- E. Site Condition Reports: Submit at time of discovery of differing conditions.
- F. Special Reports.
- G. Submittals Schedule.

1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Initial Submittal: Submit concurrently with preliminary. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacturer or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed 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.

- B. Activities: Treat each story 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 30 days, unless specifically allowed by Owner.
 - 2. Procurement Activities: Include procurement process activities for the following long lead 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.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Owner'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.

- C. 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. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 6. 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. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.

- g. Seasonal variations.
 - h. Environmental control.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. 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, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 15 days of date established for the Notice to Proceed.
- 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 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 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. Partial completions and occupancies.
 - 20. Substantial Completions authorized.
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information on AIA Form G716. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
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.
 3. As the work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to A/E, 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.

END OF SECTION 013200

SECTION 013300 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and 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.

1.2 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."
- C. Portable Document Format (PDF): A file format that provides an electronic image of text or text and graphics that looks like a printed document and can be viewed, printed, and electronically transmitted.

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by 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: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.

- c. Submittal Category: Action; informational.
- d. Name of subcontractor.
- e. Description of the Work covered.
- f. Scheduled date for Engineer's final release or approval.
- g. Scheduled dates for purchasing.
- h. Scheduled date of fabrication.
- i. Scheduled dates for installation.
- j. Activity or event number.

1.4 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. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.7 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website, Submittal Exchange or approved alternative program. 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 15 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 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittals will be returned to Architect before being returned to Contractor.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 - 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.
- 1.8 SUBMITTAL REQUIREMENTS
- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.

- b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 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 30 by 42 inches.
 - a. PDF electronic file.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Web-Based Project Software: 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.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. 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 one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
 6. 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 two set of Samples. Engineer will retain one sample sets; remainder will be returned to Contractor.
 - 1) Submit two Samples where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated. Engineer will retain one sample sets; remainder will be returned to Contractor.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.

- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of engineers and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 - 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 - 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 - 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
 - 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
 - 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - 3. Material Test Reports: Submit reports written by a 3rd party 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.

1.9 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.

1.10 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 A/E.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp indication in web-based Project software. 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. A/E will not review submittals received from Contractor that do not have Contractor's review and approval.

1.11 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 2. Submittals by Web-Based Project Software: Architect will indicate, on Project 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 discard 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

3.1 ELECTRONIC SUBMITTAL

- A. All submittals shall be made to Owner and Engineer electronically using PDF attachments.

END OF SECTION 013300

SECTION 014000 QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: 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 trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product 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: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as 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 Engineer.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 SUBMITTALS

- A. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.

1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality or more restrictive requirement shall apply.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. 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.
- F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this project.

1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, or where quality-control services are not specifically assigned to the Contractor, the 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. Contractor shall be responsible for scheduling the required tests and coordinating with the testing agencies a minimum of 24 hours in advance of time when work requiring testing or inspection will be performed.
 3. 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 explicitly assigned to the Contractor 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 shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or 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 A/E and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify A/E 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. Associated Contractor 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.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.
 1. Distribution: Distribute schedule to Owner, A/E, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the 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 modifications as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 01 45 33

CODE-REQUIRED SPECIAL INSPECTIONS

PART 1 GENERAL - NOT USED

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.

1.02 DEFINITIONS

- A. Code or Building Code: 2015 Edition of the International Building Code and, more specifically, Chapter 17 - Structural Tests and Inspections, of same.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. National Institute of Standards and Technology (NIST).
- D. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

- A. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

1.04 SUBMITTALS

- A. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- B. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Conformance with Contract Documents.
 - 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

1.05 SPECIAL INSPECTION AGENCY

- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling required by the building code.
- B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.06 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 3 EXECUTION

2.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. See Statement of Special Inspections on the structural drawings.
- B. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

2.02 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

- A. Mechanical and Electrical Components:
 - 1. Anchorage of electric equipment required for emergency or standby power systems; periodic.
 - 2. Installation and anchorage of other electrical equipment; periodic.

2.03 SPECIAL INSPECTIONS FOR WIND RESISTANCE

- A. Structural Observations for Wind Resistance: Visually observe structural system for general conformance with the approved contract documents; periodic.

2.04 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 3. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- C. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

2.05 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 2. Perform specified sampling and testing of products in accordance with specified standards.
 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
 5. Perform additional tests and inspections required by Architect.
 6. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

206 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

END OF SECTION

Statement of Special Inspections

Project: Fire Station #18 Daniel Island SC Permit Number: _____

Project Location: _____

Owner/Address: _____ City _____ Zip _____

Registered Design Professional
In Responsible Charge: Jeffrey Mark Dillon

Address: 1226 Yeamans Hall Rd

City: Hanahan State: SC Zip: 29410 Phone: 843-566-0161

E-mail: markd@adcengineering.com

This statement of Special Inspections attached is submitted as a condition for permit issuance in accordance with Section 1704 of the 2021 International Building Code. It includes a Schedule of Special Inspection Services applicable to the above referenced project as well as the identity of the individuals, agencies, or firms (completed by others) intended to be retained for conducting these inspections. The Special Inspection Coordinator (Registered Design Professional In Charge of Administering Special Inspections) shall keep records of all inspections and shall furnish interim inspection reports to the Engineer of Record (Registered Design Professional in Responsible Charge of Construction Documents) at a frequency agreed upon by the permit applicant and Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor and the Engineer of Record for correction. If the discrepancies are not corrected, the Special Inspection Coordinator shall bring the discrepancies to the attention of the Building Official and the Engineer of Record prior to the completion of that phase of work. The Special Inspection Coordinator shall submit a Final Report of Special Inspections to the building official at the conclusion of the project and before a certificate of occupancy will be issued.

Statement of Special Inspections encompass the following disciplines:

- Structural Mechanical/Electrical/Plumbing
 Architectural Other: _____

Prepared by:

Jeffrey Mark Dillon, PE

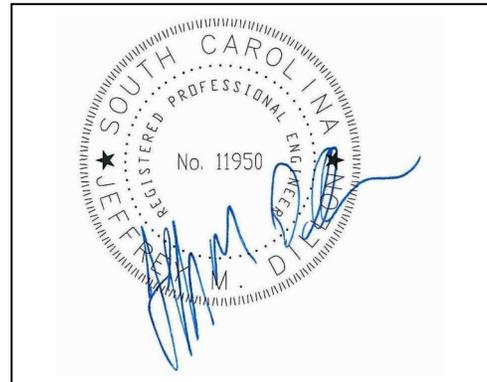
Type or Print Name



Signature

August 14, 2024

Date



Preparer's Seal and Signature Required

To be filled out by the jurisdiction and returned to applicant
Building Official's Acceptance of Special Inspections

Frequency of Interim reports: Monthly Bi-Monthly Upon Completion Per Attached Schedule

Signature

Date

TMS

Permit Number

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections includes the following building systems:

- | | |
|--|---|
| <input checked="" type="checkbox"/> Soils and Foundations | <input type="checkbox"/> Wood Construction |
| <input checked="" type="checkbox"/> Cast-in-Place Concrete | <input checked="" type="checkbox"/> Architectural Components |
| <input type="checkbox"/> Precast Concrete | <input checked="" type="checkbox"/> Mechanical & Electrical Systems |
| <input type="checkbox"/> Masonry | <input type="checkbox"/> Storage Racks |
| <input checked="" type="checkbox"/> Structural Steel | <input type="checkbox"/> Spray Fire Resistant Material |
| <input type="checkbox"/> Cold-Formed Steel Framing | <input checked="" type="checkbox"/> Special Cases |

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. Special Inspection Coordinator (Registered Professional in Responsible Charge of Administering Special Inspections)		
2. Inspector		
3. Inspector		
4. Testing Agency		
5. Testing Agency		
6. Other		

Note: The inspectors and testing agencies shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

Qualifications of Inspectors and Testing Technicians

The qualifications of all personnel performing Special Inspection and testing activities are subject to the approval of the Building Official and shall be in accordance with the building code or any particular requirements of the specifications or material specific referenced standards. The credentials of all Inspectors and testing technicians shall be provided if requested.

Special Inspection Definitions

Continuous Special Inspection - Special inspection by the special inspector who is present when and where the work to be inspected is being performed.

Periodic Special Inspection - Special inspection by the special inspector who is intermittently present where the work to be inspected has been or is being performed. Unless noted otherwise 100% of the work designated for inspection shall be inspected.

MATERIAL / ACTIVITY	SCOPE OF SERVICE
1704.2.5 Special Inspection of Fabricated Items	
Structural Steel Fabrication: Verify Fabrication/Quality Control Procedures	Verify Steel Fabrication plant is AISC certified

MATERIAL / ACTIVITY	SCOPE OF SERVICE
1705.1.1 Special Cases	
Post Installed Anchors	
Installer Qualifications	Review installer training records to confirm they have received manufacturer training per the contract documents
Anchor Installation	Continuously inspect complete process of anchor installation in accordance with requirements of approved ICC ESR report. As minimum review installation procedures including drill bit type, drilling methods, hole preparation and cleaning, spacing, edge distance, embedment depth, adhesive installation, rod installation, curing time, and anchor torque to ensure compliance with manufacturer's instructions and construction documents. (All anchor holes must be inspected during drilling, all anchor holes must be inspected prior to anchor installation, all anchors shall be inspected at final application of required torque)

MATERIAL / ACTIVITY	SCOPE OF SERVICE
1705.2.1 Structural Steel	
Review fabricator's source quality assurance inspection and testing report submittals	Periodically review fabricator's source quality assurance inspection and test reports to ensure all inspection and testing is being completed as required and appropriate standards are being met. (100% rate for all source quality control report submittals.)
Conduct inspections after field welding in accordance with AISC 360-10 Table N5.4-3	<p>Periodically confirm that welds have been cleaned. (100% inspection rate with a minimum rate of once weekly during welding operations)</p> <p>Periodically confirm weld size, length and location. (100% inspection rate with a minimum rate of once weekly during welding operations)</p> <p>Periodically confirm weld meets visual acceptance criteria including crack prohibition, weld/base-metal fusion, crater cross section, weld profiles, weld size, undercut, and porosity. (100% inspection rate with a minimum rate of once weekly during welding operations)</p>
Conduct Inspections after high strength bolting in accordance with AISC 360-10 Table N5.6-3	Periodically document acceptance or rejection of bolted connections. (100% rate with a minimum rate of once weekly during welding operations)
Other inspection Task	<p>Periodically inspect placement of anchor rods and other embedded items prior to concrete/masonry grout placement operations. Confirm diameter, grade, type and length of the anchor rod or embedded item, and the extent or depth of embedment into concrete/masonry grout. (100% inspection rate immediately prior to concrete/masonry grout placement operation)</p> <p>Periodically inspect the steel frame to verify compliance with the details shown on the construction documents including braces, stiffeners, member locations, and proper application of joint details at each connection. (100% inspection rate with a minimum rate of once weekly during steel erection operations)</p>
(Continued) Conduct inspections after field welding in accordance with AISC 360-10 Table N5.4-3	Periodically document acceptance or rejection of welded joint or member. (100% inspection rate with a minimum rate of once weekly during welding operations)

MATERIAL / ACTIVITY	SCOPE OF SERVICE
1705.3 Concrete Construction	
Inspection of reinforcing steel, including prestressing tendons, and placement	<p>Periodically inspect reinforcing steel placement in accordance with contract documents and approved shop drawings to confirm size, spacing, cover, positioning, bends, grade, laps, supports and anchorage. (100% inspection rate immediately prior to placing concrete)</p>
Inspection of anchors cast in concrete	<p>Periodically inspect size, positioning, embedment, and projection of anchor rods is in accordance with contract documents and approved shop drawings. (100% inspection rate immediately prior to placing concrete)</p> <p>Continuously inspect concrete placement and consolidation around anchors. (100% inspection rate during concrete placement)</p>
Inspection of anchors post-installed in hardened concrete members.	<p>Review installer training records to confirm they have received manufacturer training per the contract documents</p> <p>Continuously inspect complete process of anchor installation in accordance with requirements of approved ICC ESR report. As minimum review installation procedures including drill bit type, drilling methods, hole preparation and cleaning, spacing, edge distance, embedment depth, adhesive installation, rod installation, curing time, and anchor torque to ensure compliance with manufacturer's instructions and construction documents. (All anchor holes must be inspected during drilling, all anchor holes must be inspected prior to anchor installation, all anchors shall be inspected at final application of required torque)</p>
Verifying use of required design mix	<p>Periodically review batch tickets to confirm the appropriate approved mix design is being used for the location in which concrete is being placed (100% review rate during concrete placement)</p> <p>Periodically verify that water added at the site does not exceed that allowed by the batch ticket (100% inspection rate during concrete placement)</p>
Sample fresh concrete to fabricate specimens for strength tests, perform fresh unit weight density, slump and air content tests, and determine the temperature of concrete	<p>Continuously test concrete compressive strength (ASTM C31 & C39), fresh unit weight density (ASTM C138), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064).</p> <p>Samples for preparing unit weight density specimens and measuring air content shall be obtained at the point of placement.</p> <p>Slump measurements are for reference only and shall not be a basis of rejection.</p> <p>Threshold for fresh unit weight density shall be in accordance with approved mix design submittals</p> <p>(Frequency of sampling and testing as required by section 21.16 of ACI 318)</p>

MATERIAL / ACTIVITY	SCOPE OF SERVICE
1705.3 Concrete Construction (Continued)	
Inspection of concrete for proper application techniques	Continuously inspect concrete placement techniques to confirm compliance with section 26.5 of ACI 318.
Inspection for maintenance of specified curing temperatures and techniques	Periodically inspection curing temperatures and techniques to insure compliance with contract documents and sections 26.5.3, 26.5.4 and 26.5.5 of ACI 318
Inspection of formwork for shape, location and dimensions of concrete member being formed	Periodically inspect formwork to ensure compliance with dimensions of members indicated on contract documents (100% inspection rate during concrete placement)

MATERIAL / ACTIVITY	SCOPE OF SERVICE
1705.6 Soils	
Verify materials below shallow foundations are adequate to achieve the design bearing capacity	Periodically inspect soils within building footprint for adequate bearing capacity and consistency with the geotechnical report. (100% inspection rate)
Verify excavations are extended to proper depth and have reached proper material	Periodically inspect all footing excavations to ensure they are to proper depth and have reached proper material as indicated on contract documents and/or geotechnical report. (100% inspection rate immediately prior to placement to reinforcing steel for foundations) Periodically inspect all unsuitable material excavations to ensure they are to proper depth and have reached proper material as indicated on contract documents and/or geotechnical report. (100% inspection rate of all areas of unsuitable fill removal immediately prior to placement of fill)
Perform classification testing of compacted fill materials.	Periodically perform testing of fill materials to ensure compliance with contract documents and geotechnical report. Classification and testing shall be in accordance with the Geotechnical report. Where the geotechnical report does not specifically indicate testing, the minimum testing shall be sieve tests (ASTM D422 & D1140) and Standard Proctor tests (ASTM D98). (Testing shall be completed for each source of material, or where obvious changes of properties of fill materials are realized)
Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	Continuously verify materials for compacted fill to ensure materials have been previously tested and are in compliance with the contract documents and geotechnical report. (100% inspection rate) Periodically test density of each lift of fill within the building footprint to confirm compliance with compaction requirements outlined in the contract documents and geotechnical report. (Where inspection rates are not indicated in the geotechnical report, not less than one test per each lift per 2000 sq ft of fill placed) Continuously verify lift thicknesses are during placement of compacted fill to ensure lift thickness is in compliance with the contract documents and geotechnical report. (100% inspection rate)
Prior to placement of compacted fill, inspect subgrade and verify that the site has been prepared properly.	Periodically inspect subgrade within the building footprint prior to placement of compacted fill to ensure subgrade complies with contract documents and geotechnical report. (100% inspection rate of all areas immediately prior to placement of fill)

MATERIAL / ACTIVITY	SCOPE OF SERVICE
1705.11 Special Inspections for Wind Resistance	
1705.11.3 Wind Resisting Components	<p>Periodically inspect the installation of Roof Cladding is in accordance with approved submittals and manufacturer's installation requirements (Random inspection rate for general conformance with a minimum rate of once weekly during roof cladding installation)</p> <p>Periodically inspect the installation of Wall Cladding is in accordance with approved submittals and manufacturer's installation requirements (Random inspection rate for general conformance with a minimum rate of once weekly during wall cladding installation)</p>
MATERIAL / ACTIVITY	SCOPE OF SERVICE
1705.12 Special Inspections for Seismic Resistance	
1705.12.5 Architectural Components	<p>Periodically inspect the erection and fastening of exterior wall cladding to ensure compliance with specifications, approved submittals and manufacturer's installation requirements. (Random inspection rate for general conformance with a minimum rate of once weekly during cladding installation)</p> <p>Periodically inspect the erection and fastening of interior and exterior veneers to ensure compliance with specifications, approved submittals and manufacturer's installation requirements. (Random inspection rate for general conformance with a minimum rate of twice weekly during cladding installation)</p> <p>Periodically inspect installation of interior and exterior nonbearing walls to ensure installation is in accordance with construction documents, specifications, and approved shop drawing submittals and/or manufacturer's instructions. Inspection shall include verifications of fastening of wall components and wall anchorages including number, type and spacing of fasteners as well as confirmation that installed connections allow for specified vertical and/or drift deflections. (100% inspection rate with a minimum inspection rate of once weekly during nonbearing wall installation.)</p>

SECTION 015000 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. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

- A. General: Cost or charges for temporary facilities shall be included in the Contract Sum (unless noted otherwise). Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner, Architect, testing agencies, and authorities having jurisdiction.
 - i. Temporary facilities shall be at the Contractor's discretion unless otherwise indicated in the plans and specifications.
- B. Water Service: Provided by Owner.
- C. Sewer Service: N/A
- D. Electric Power Service: Provided by Owner.

1.4 QUALITY ASSURANCE

- A. Electric Service: Provided by Owner.
- B. Tests and Inspections: If required arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

PART 2 PRODUCTS

2.1 MATERIALS (Not Used)

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve project adequately and result in minimum interference

with performance of the work. Relocate and modify facilities as required by progress of the work.

- 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.

3.2 TEMPORARY UTILITY INSTALLATION

- A. Telephone Service: Provide superintendent with cellular telephone for use when away from office.
- B. Electronic Communication Service: Provide electronic communication service, including electronic mail, in Contractor's office.
- C. Sanitary Service: Provide temporary toilets, wash facilities and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities and access for emergency vehicles.
 - 3. Maintain access for fire-fighting equipment and access to fire hydrants.
 - 4. Protect non-owned vehicular traffic.
 - 5. Provide means of removing mud from construction related vehicle wheels before entering streets.
- C. Parking: Coordinate with Owner for temporary parking areas within project site for construction personnel.
- D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.
- E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing building areas and facilities outside the scope of work, 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 owners to access property for that purpose.
 - 2. Contractor shall be responsible for establishing and maintaining site security as

warranted by site conditions.

3. Contractor shall prohibit public access to the area of work until Substantial Completion is obtained. Utilize appropriate fencing, gates, signage, etc.
 4. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
 5. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures and to prevent entry of unauthorized persons.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that 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 Division 01 Section "Summary."
- C. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
1. Temporary detour signage shall be developed and posted at each potential public access point of the project (ten locations).
 - A. Signs shall be weather and vandal resistant, minimum 18" x 24" in size.
 - B. Indicate alternative routes for pedestrians and cyclists, either graphically or in simple text form.
 - C. Contractor contact information shall be included on the sign.
 - D. Signs shall be replaced as needed throughout the contract term.
- D. 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.
1. Prohibit smoking on the project site and areas of work.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to 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.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary and Owner provided utilities and 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.
- 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. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

3.6 Project Identification

- A. Provide project identification sign. Coordinate with Owner for sign design. Erect on site at location approved by Owner. No other signs are permitted without Owner permission except those required by law.

END OF SECTION 015000

SECTION 016000 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This 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; product substitutions; and comparable products.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. A/E's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of A/E's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if A/E does not issue a decision on use of a comparable product request within time allocated.
 - 3. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
- B. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.
 - 1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality product shall be used.

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. 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 ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.

2. Store materials in a manner that will not endanger project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 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.
- B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Engineer's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 5. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the

specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.

6. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
7. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Engineer's sample. A/E's decision will be final on whether a proposed product match.
8. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, 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 these requirements:
 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in- service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 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 engineers and owners, if requested.
 5. Samples, if requested.

2.3 PRODUCT SUBSTITUTIONS

- A. Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

PART 3 EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

- A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- B. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work
 - 4. Dates: Indicate when cutting and patching will be performed
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems
- C. Certified Surveys: As required for As-Built and/or permit close-out processes.

1.4 QUALITY ASSURANCE

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

- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities.
 - 5. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding
- D. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.
 - 1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality or more restrictive requirement shall apply.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, underground and other utilities, and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of site improvements, underground utilities and other utilities, and other construction affecting the work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water-service piping, and underground electrical services.
 - 2. Furnish location data for work related to project that must be performed by public utilities serving project site.
- B. Acceptance of Conditions: 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. Written Report: Where a written report listing conditions detrimental to performance of the work is required by other Sections, include the following:
 - a. Description of the work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.

- d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. 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.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.
 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of project.
 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the work progresses.
 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
- B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- C. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 INSTALLATION

- A. General: Locate the work and components of the work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results.

EXECUTION

Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations so no part of the work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels without providing appropriate PPE to all personnel and mitigating noise trespass to adjacent properties.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
 - 2. 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.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to 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. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 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 construction personnel 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. General: Clean project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- 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. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- F. 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.
- G. 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.
- H. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or

otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 02 specifications for the materials and finishes requiring replacement and/or restoration.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700 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. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial completion procedures
 - 2. Inspection procedures
 - 3. Final completion procedures
 - 4. Warranties
 - 5. Project Record Documents
 - 6. Operation and Maintenance Data
 - 7. Final cleaning

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Where applicable, make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Submit test/adjust/balance records.
 - 10. Terminate and remove temporary facilities from project site, along with mockups, construction tools, and similar elements.
 - 11. Advise Owner of changeover in heat and other utilities.
 - 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 13. Complete final cleaning requirements, including touchup painting.
 - 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer 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 Engineer, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 - 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. 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. Reinspection: Request reinspection when the work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A or other approved form.
 - 1. Organize list of spaces in sequential order.
 - 2. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of A/E.
 - d. Name of Contractor.
 - e. Page number

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of A/E for designated portions of the work where commencement of warranties other than date of Substantial Completion is

indicated.

- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit electronically.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.
- F. Where required, provide warranties, bonds, and certifications to authorities having jurisdiction as necessary for their acceptance of the work for operation and maintenance.

1.7 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Contract drawings.

1.8 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.9 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

1.10 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Provide control diagrams by controls manufacturer as installed.
- J. Additional Requirements: As specified in individual product specification sections.

1.11 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. Binders: Commercial quality, 8-1/2 by 11-inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

- H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.

PART 2 PRODUCTS

2.1 MATERIALS

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

PART 3 EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire project or for a portion of project:
 - a. Clean project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

- d. Remove tools, construction equipment, machinery, and surplus material from project site.
 - e. Remove snow and ice to provide safe access.
 - 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 labels that are not permanent.
 - h. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - i. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - j. Replace parts subject to unusual operating conditions.
 - k. Leave project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017900 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.
 - 2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 01 78 00 Closeout Submittals.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, 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.
 - 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.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module.
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 3 EXECUTION

2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.
 - 8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

2.02 EXISTING UTILITIES

- A. Protect existing utilities to remain from damage.

- B. Do not disrupt public utilities without permit from authority having jurisdiction.
- C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Patch walls flush with similar materials at intersections where existing walls have been demolished.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Remove, store and protect existing mechanical equipment to be reinstalled as part of new construction.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

2.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Grade beams.
 - 3. Slabs-on-grade.
 - 4. Slabs on deck.
- B. Products installed, but not furnished, under this Section include the following:
 - 1. Anchor rods and embed plates indicated to be cast into cast-in-place concrete, furnished under Division 05 Section "Structural Steel Framing"
- C. Related Sections:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

1.03 PERFORMANCE REQUIREMENTS

- A. Moisture level in finished concrete shall be within limits acceptable to types of finish flooring indicated. Test methods and acceptable limits shall be as specified in Division 09 finish flooring Sections, or as required by finish flooring manufacturer's written product data or certified written statement. General Contractor is responsible for choosing and implementing methods of limiting excessive moisture during construction and curing, or remedial treatment, process, or other means to bring moisture level within acceptable limits, and for assigning and contracting for these responsibilities to installers

1.04 DEFINITIONS

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

1.05 SUBMITTALS

- A. Contractor's Statement of Responsibility Per Division 01 Section "Collective Inspections and Structural Testing"
- B. Design Mixtures: For each concrete mixture.
 - 1. Mix design submittals shall include test results and/or trial batch data that meet or exceed the required average compressive strength as required by ACI 301.
 - 2. Trial batches shall consist of identical cementitious materials, fine and course aggregates, and admixtures to be used for mix design.
 - 3. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 4. Design mixtures shall be coordinated with means of transport from point of delivery to point of placement. Allowances shall be made for changes in properties due to means of transport (from point of delivery to point of placement).
 - 5. For mixes to be transported (i.e. pumped) from point of delivery to point of placement include a statement as to the expected property changes (i.e. unit weight and air content) from point of delivery to point of placement.
- C. Steel Reinforcement Shop Drawings:
 - 1. Drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and bar supports for concrete reinforcement.
 - 3. Identify all step footing locations and associated reinforcing

4. Identify and dimension all grade beam and tie beam construction joints
5. Include slab on grade construction joint reinforcement
6. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.
- D. Qualification Data:
 1. For ready-mix concrete manufacturer.
 2. For Cartridge injection adhesive installer. Include manufacturer's training certificates or letter from manufacturer certifying training was complete with a list of individuals that were trained
- E. Material Certificates: For each of the following indicating compliance with the required standards and signed by manufacturers:
 1. Vapor retarders
- F. Research/Evaluation Reports:
 1. Submit ICC reports for the following:
 - a. Cartridge Injection Adhesive
- G. Hot Weather Program (As required, see below):
 1. Describe in detail procedure for working in Hot Weather when concrete temperatures exceed the specified limits. Included detailed description of methods, materials, and equipment to be used to comply with requirements.
- H. Substitutions for Cartridge Injection Adhesive:
 1. Substitution requests may only be made using products with ICC-ESR reports for the product in the specific substrate.
 2. Substitution request shall include signed and sealed calculations demonstrating that the product is capable of providing equivalent performance of the specified product for each specific location and condition when calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code.
 3. Substitution request shall specify the diameter and embedment depth of the substituted product
 4. Any increase in material cost resulting from the substitution shall be the responsibility of the contractor.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: The installer shall be experienced placing, finishing, curing, treating and protecting concrete equal in material, design and scope to that required for this project
- B. Cartridge Injection Adhesive Installer Training: Conduct a thorough training session with the manufacturer's representative. Each individual responsible for the installation of anchors shall attend the training session. Training shall consist of a review of the complete process for the installation of the anchors and the use of proper equipment for drilling and installing the anchors, to include but not limited to:
 1. Hole drilling procedure. Clarify acceptability of rotary hammer drilling and/or core drilling.
 2. Hole drilling equipment
 3. Type and diameter of drill bits
 4. Hole preparation and hole cleaning technique
 5. Hole cleaning equipment
 6. Adhesive injection technique
 7. Adhesive injection equipment
 8. Adhesive curing requirements
- C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- D. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
 - E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
 - F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 3. ACI 318, "Building Code Requirements for Structural Concrete".
 - G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- 1.07 DELIVERY, STORAGE, AND HANDLING**
- A. Steel Reinforcement:
 1. Deliver, store, and handle steel reinforcement to prevent bending and damage.
 2. Maintain reinforcement free of dirt and other deleterious materials.
 3. Store reinforcing on dunnage or other supports up off of ground.

PART 2 - PRODUCTS**2.01 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars:
 1. ASTM A 615/A 615M, deformed, Grade 60.
- B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Concrete Brick, Standees, Bolsters, chairs, spacers, supplementary reinforcing steel and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place including measures for supporting and anchoring reinforcing intermediate and top layers of reinforcing. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 2. Concrete brick supports are limited to use in supporting the bottom mat of below grade foundation reinforcing steel. Concrete brick supports shall consist of solid units of unit strength equal to or greater than associated foundation concrete. Submit material test reports for approval.
- C. Cartridge Injection Adhesive: A two part adhesive injection system for anchorage of new reinforcing steel to existing concrete construction.
1. Where adhesive manufacturer is not indicated, subject to compliance with requirements and acceptance by the Architect, provide the following or approved equal:
 - a. Hilt HIT RE 500 V3 Adhesive Anchorage System, ICC ESR-3814.
- 2.04 CONCRETE MATERIALS**
- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I, Type I/II or Type III unless noted otherwise.
Supplement with Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
1. Coarse Aggregate
 - a. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - b. Class: Per ASTM C33 requirements for the concrete use and region of the project
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.
- D. Water: ASTM C 94/C 94M and potable.
- 2.05 ADMIXTURES**
- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Accelerating Admixture: Non-Chloride, ASTM C494/494M, Type C.
 4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- 2.06 VAPOR BARRIERS**
- A. Vapor barrier shall have all of the following qualities:
1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- B. Vapor barrier products:
1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC
 2. Approved Alternate: Vaporguard by Reef Industries
 3. Approved Alternate: Miostop Ultra 15 Mil
 4. No substitutions
- C. Seam Tape: Manufacturer's recommended adhesive or pressure-sensitive tape.
- 2.07 CAPILLARY BARRIERS:**

- A. A clean, compactable and trimmable granular fill with material passing the No. 200 sieve having less than 3 percent clay or friable particles. The material shall remain stable and support construction traffic and complying with one of the following:
 1. A local state DOT approved road base material with 100 percent passing the 1 ½" sieve, 15 to 55 percent passing the No. 4 sieve, and less than 5% passing the No. 200 sieve.
 2. A material complying with ASTM D1241, Type I with less than 5% passing the No. 200 sieve.

2.08 LIQUID FLOOR TREATMENTS

- A. See architectural specifications.

2.09 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.010 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: Provide one of the following.
 1. Flexible lightweight, non-staining, polythelene, closed cell, non-absorbent, uv stable, compressible foam with a pre-scored removable strip to allow for clean and uniform sealant joint as follows:
 - a. Density: ASTM D1751
 - b. Compression: ASTM D3575
 - 1) 10% Deflection: 10 psi maximum
 - 2) 80% Deflection: 126 psi maximum
 - c. Water absorption: ASTM D3575, 0.5% volume maximum
 2. Resilient, flexible, non-extruding, asphalt-saturated cellulosic fiber with preformed cap to allow for clean and uniform sealant joint
 - a. Density: ASTM D 1751
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 1. Type V, for bonding freshly mixed concrete to hardened concrete.

2.011 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Compressive Strengths: Compressive strengths specified are as required for structural design. Compressive strength provided shall be increased as required by ACI 318 for exposure class or as required for specialty treatments or finishing of concrete (i.e. polishing)
- C. Air Content: Shall be adjusted as required for exposure class, specialty treatments or finishing of concrete.
- D. Exposure Class: Unless noted otherwise in drawings or specifications concrete shall be considered exposure class F0, S0, W0 and C0.
- E. Coordination with means of transport (from point of delivery to point of placement):
 1. Design mixtures shall be coordinate with means of transport from point of delivery to point of placement. Allowances shall be made in the mix design for changes in properties due to means of transport (from point of delivery to point of placement). Specifically an allowance shall be made for loss of air entrainment due to transport methods (i.e

concrete pump) when air entrainment is explicitly specified or where air entrainment is used as part of achieving lightweight concrete.

2. Coordinate with schedule of special inspections for instances in which concrete properties are to be explicitly confirmed at point of placement.

F. Admixtures: Use admixtures as noted in mix design and according to manufacturer's written instructions.

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

2.012 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings other than grade beams and moment frame footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Dry Unit Weight: 145 lb/cu. ft. plus or minus 3 lb/cu. ft.

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

1. Minimum Compressive Strength:
 - a. Typical Slabs: 3000 psi at 28 days.
 - b. Polished Finished Slabs: Minimum 3500 psi at 28 days, but not less than typical slab strength
2. Dry Unit Weight: 145 lb/cu. ft. plus or minus 3 lb/cu. ft.
3. Air Content:
 - a. Coordinate target air content with exposure requirements
 - b. Maximum air content for slabs to receive trowel finish shall be 3 percent at point of placement.
4. Cementitious Materials:
 - a. Minimum Cementitious Materials Content: Per ACI 301 requirements based on max aggregate size
 - b. For slabs to receive a polished finish fly ash shall not be permitted

C. Slab on Deck: Proportion structural lightweight concrete mixture as follows:

1. Minimum Compressive Strength:
 - a. Typical Slabs: 3500 psi at 28 days.
 - b. Polished Finished Slabs: Minimum 3500 psi at 28 days, but not less than typical slab strength
2. Calculated Equilibrium Unit Weight: 115 lb/cu. ft. plus or minus 3 lb/cu. ft. **at point of placement** as determined by ASTM C 567.
3. Air Content:
 - a. Coordinate target air content with exposure requirements
 - b. Maximum air content for slabs to receive trowel finish shall be 3 percent at point of delivery

4. Cementitious Materials:
 - a. Minimum Cementitious Materials Content: Per ACI 301 requirements based on max aggregate size
 - b. For slabs to receive a polished finish fly ash shall not be permitted
5. Exposure Classes:
 - a. Freeze/Thaw Exposure: F0
 - b. Sulfate Exposure: S0
 - c. Water Contact Exposure: W0
 - d. Corrosion Exposure: C0

2.013 FABRICATING REINFORCEMENT

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

2.014 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. Unless a detailed hot weather concrete plan incorporating the recommendations of ACI 305 has been submitted and approved comply with the following:
 - a. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes.
 - b. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.015 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting flowable concrete material produced from the following:
 1. Portland Cement: ASTM C 150, Type I Type II or Type III.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94/C 94M.
 6. Air-Entraining Admixture: ASTM C 260.
- B. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

PART 3 - EXECUTION**3.01 FORMWORK**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 1. Smooth-formed finished surfaces: Class A, 1/8 inch
 2. Rough-formed finished surfaces: Class D, 1 inch
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Anchor rods and embeds shall be securely fastened in formwork prior to placing concrete, and concrete vibrated around the anchor or embed to ensure proper flow of concrete around anchors and embeds.
 - 3. Anchor rod sleeves (where required) shall be accurately located and fastened in formwork prior to placing concrete.
 - 4. Wet setting of anchor rods and embeds is not permitted.

3.03 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 VAPOR BARRIERS

- A. Install vapor barrier in accordance ASTM E1643 and manufacturer's written instructions.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 - 2. At conditions terminating into a wall, it is important that continuity of the vapor barrier is maintained and sealed to the exterior stem wall or slab turn-down.
 - a. Complete termination to exterior conditions as indicated on drawings for typical conditions, i.e following specific procedure for turning a strip of vapor retarder down and sealing to wall or footing, compacting the earth at the perimeter, and lapping back onto field vapor barrier and sealing all joints.
 - b. Alternatively, contractor may turn vapor retarder up wall, extend to top of slab and seal to wall with manufacturer's tape in strict accordance with manufacturer's recommendations.

- c. Specific conditions that compromise continuity of the vapor barrier seal to the exterior wall should be brought to the attention of the architect, and an alternative solution devised that fulfills the intent of the vapor barrier.
3. Overlap joints per manufacturer, but not less than 6 inches and seal with manufacturer's seam tape.
4. Manufacturer's seam tape shall be applied to a clean and dry vapor barrier in strict accordance with the manufacturer's recommendations.
5. Extend vapor barrier to edge of slab in all cases.
6. Seal all penetrations (including pipes and permanent stakes) per manufacturer's instructions.
7. Do not use non-permanent stakes driven through the vapor barrier.
8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile strength. Seal with manufacturer's tape or mastic in strict accordance with manufacturer's recommendations for repair.

3.05 CAPILLARY BARRIERS:

- A. General: Place capillary barrier on compacted subgraded beneath vapor retarder for all slabs on grade unless noted otherwise.
 1. Compact capillary barrier with mechanical equipment to an elevation tolerance of plus 0 and minus $\frac{3}{4}$ inch.
 2. Capillary barriers are not required where mud slabs and below slab sheet waterproofing are indicated.
 3. Ensure surface of capillary barrier is uniform to prevent damage to vapor retarders.
 4. Ensure capillary barrier is compacted to a uniform surface free of ruts, divots or other anomalies from construction traffic. Repair any anomalies immediately prior to concrete placement.

3.06 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Anchorage of reinforcement into hardened concrete using cartridge injection adhesive anchors shall only be used where specifically indicated on plans or with written direction from the Engineer of Record for a specific location.
- D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 1. Foundation reinforcing steel may be supported on solid concrete brick units of strength equal to or greater than foundation concrete.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Welded Wire Reinforcement:
 1. Install welded wire reinforcement in longest practicable lengths
 2. Locate welded wire reinforcement in top 1/3 of slab on grades unless noted otherwise
 3. Locate welded wire reinforcement at mid-depth of concrete slab thickness over deck flutes unless noted otherwise.
 4. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2", but not less than 6". Lace overlaps with wire.
 5. Slabs on Grade 4" or less in thickness: Support welded wire reinforcement on chairs, bolsters or bar supports spaced to minimize sagging, and as required to support construction traffic
 - a. Alternately, welded wire reinforcement may be placed on grade and "hooked"/pulled to the proper location

- b. Placement of welded wire reinforcement after placement of concrete and "walking in" is not permitted.
- 6. Slabs on Grade greater than 4" in thickness: Support welded wire reinforcement on chairs, bolsters or bar supports spaced to minimize sagging, and as required to support construction traffic
 - a. Placement of welded wire reinforcement on grade or deck and "hooked"/pulled up into slab as concrete is placed is not permitted.
 - b. Placement of welded wire reinforcement after placement of concrete and "walking in" is not permitted.
- 7. Elevated slabs: Support welded wire reinforcement on chairs, bolsters or bar supports spaced to minimize sagging, and as required to support construction traffic
 - a. Alternately, welded wire reinforcement may be placed on grade and "hooked"/pulled to the proper location
 - b. Placement of welded wire reinforcement after placement of concrete and "walking in" is not permitted.

3.07 CARTRIDGE INJECTION ADHESIVE

- A. Where manufacturer recommends the use of special tools for installation of anchors, such tools shall be used.
- B. All facets of hole drilling, hole cleaning, anchor installation, anchor torqueing shall be in strict accordance with the ICC-ESR report and manufacturer's data.
- C. Drill holes perpendicular to substrate surface.
- D. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits as indicated in the ICC-ESR report.
- E. Drill bits and core bits shall be of diameters indicated in the ICC-ESR report.
- F. All holes shall be cleaned with compressed air to remove all drilling dust and other deleterious substances.
- G. Remove water from holes to attain a surface dry condition unless specifically permitted otherwise by ICC-ESR report.
- H. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete has achieved full design strength.
- I. Hilti HIT-HY200 system adhesive shall be installed using the Hilti Safe Set Technology.
 - 1. The Hilti hollow drill bit and Hilt vacuum system shall be employed.
- J. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
- K. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- L. Follow manufacturer recommendations to ensure proper mixing of adhesive components.
- M. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface.
- N. Remove excess adhesive from the surface.
- O. Shim reinforcement with suitable device to center the reinforcement in the hole.
- P. Do not disturb or load reinforcement before manufacturer specified cure time has elapsed.
- Q. Observe manufacturer recommendations with respect to installation temperatures.

3.08 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Provide supplemental reinforcing and/or smooth dowels where indicated at joints.
 - 4. Strip bulkheads from footings, beams, grade beams, tie beams, and slabs and roughen surface of concrete to a minimum 1/4" amplitude while concrete is still plastic.

5. Form keyed joints unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete unless noted otherwise.
 6. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 7. Locate joints in slabs on steel deck as follows:
 - a. Joints parallel to joists (perpendicular to girders) shall be located at the midpoint between two adjacent joists.
 - b. Joints parallel to girders (perpendicular to joists) shall be located at the midpoint of two adjacent girders.
 - c. Stagger and offset joints as required to meet the requirements.
 8. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 9. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 10. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least [one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete.
 - a. Cut joints as soon as cutting action will not tear, abrade, or otherwise damage surface, but not more than 12 hours after finished, and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.09 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 and as follows.
 1. Do not add water to concrete unless the batched water is specifically noted as less than the mix design and is indicated as such on the batch ticket.
 2. Do not add more water than the amount of withheld water which is specifically identified on the batch ticket.
 3. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Concrete placed over metal deck shall be placed and screeded level and flat to the specified tolerances, maintaining at least the minimum specified slab thickness as shown on drawings. The contractor shall increase slab thickness as required to compensate for metal deck deflection, residual beam camber and beam deflection in order to achieve a level and flat floor within the specified tolerance.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 305.1 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement unless a detailed hot weather concrete plan incorporating the recommendations of ACI 305.1 has been submitted and approved. At no time shall concrete temperature exceed 95 deg F at time of placement.
 2. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- 3.010 FINISHING FORMED SURFACES**
- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to be covered with a coating or covering material applied directly to concrete coordinate with Architectural drawings and specifications.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent

formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.011 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish, trowel and fine broom finish, or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
 - 2. Apply to mud slabs.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, epoxy terrazzo, polished or another thin-film-finish coating system.
 - 2. Flatness and Levelness: FF 25, FL 35
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method without cleavage membrane. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.012 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.013 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing

- operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
 - D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
 - E. Foundations:
 - 1. Protect top sides of footings to receive masonry or concrete construction from dirt and debris.
 - 2. Excavations:
 - a. Do not allow excavations directly adjacent to or beneath footings to the absolute greatest extent possible.
 - b. Where excavations must occur beneath in place footings or slabs the area shall be careful excavated as to not damage structural elements. The area shall be backfilled and compacted at the end of the work day.
 - c. Areas excavated below footings shall be backfilled with Controlled Low-Strength Material.
 - d. Areas excavated adjacent to and at or below footing elevation shall be backfilled with Controlled Low-Strength Material unless the area is large enough to be backfilled with control fill in lifts attaining proper compaction between lifts.
 - F. Slabs:
 - 1. Protect slabs to remain expose, stained or receive other non-opaque floor coverings or treatments with impervious covers to prevent staining of the slab
 - 2. Do not allow construction equipment or vehicles to drive on slabs.
 - 3. Excavations:
 - a. Do not allow excavations directly adjacent to or beneath slabs on grade to the absolute greatest extent possible.
 - b. Where excavations must occur beneath in place footings or slabs the area shall be careful excavated as to not damage structural elements. The area shall be backfilled and compacted at the end of the work day.
 - c. Areas excavated below slabs shall be backfilled with Controlled Low-Strength Material. Areas excavated adjacent to and at or below slab elevation shall be backfilled with Controlled Low-Strength Material unless the area is large enough to be backfilled with control fill in lifts attaining proper compaction between lifts.
 - d. Repair vapor retarders per manufacturer's requirements
 - G. Cure concrete according to ACI 308.1, as follows:
 - 1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments or polished finish.
 - b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
 - a. Apply curing and sealing compound to areas of exposed concrete not to receive any floor treatment, staining, painting or floor covering. Coordinate with finish schedule.

3.014 LIQUID FLOOR TREATMENTS

- A. See architectural specifications.

3.015 CONCRETE REPAIRS

- A. Where deficient concrete is identified on the job all repairs shall be subject to the EOR and AOR approval.
- B. The contractor shall be responsible for enlisting a concrete repair specialists with no less than 5 years of documented concrete repair service and having repaired deficient conditions similar to those identified on no less than 5 projects in the previous five years.
- C. The contractor and repair specialists shall prepare a narrative of the proposed repair including detailed methods and material, and submit for EOR approval prior to commencing with repairs.
- D. Where repair of deficient work is to remain exposed, the deficient work shall be removed and replaced as directed by the EOR.

3.016 JOINT FILLING

- A. Fill all joints in exposed concrete slabs
- B. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- D. Install semirigid joint filler full depth in saw-cut joints and at least 1 deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.017 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 in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.018 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect in accordance with manufacturer's recommendations.

END OF SECTION 033000

SECTION 050520**POST INSTALLED STRUCTURAL ANCHORS****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:
 - 1. Wedge anchors
 - 2. Cartridge injection adhesive anchors
- B. This specification section is only intended for use when specifically required by the drawings or other referencing specifications and structural applications. This section is not intended for use in non-structural applications or where not specifically referenced by the drawings or other specification sections.
- C. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Structural Steel Framing" for anchorage of structural steel.
 - 3. Division 05 Section "Cold Formed Metal Framing" for anchorage of cold form metal framing where specifically detailed in the contract documents.

1.3 PERFORMANCE REQUIREMENTS

- A. The basis of design products are as specified in this specification or the contract documents. Product substitutions must have capacities equal to or greater than values calculated for each specific condition calculated when calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code. See requirements for substitution submittals.

1.4 DEFINITIONS

- A. Post Installed Structural Anchors: Anchors supporting and/or anchoring structural elements of the building which are installed into hardened concrete or masonry and that are specified in the contract documents or performance based shop drawing design submittals for structural elements.
- B. Wedge Anchors: A torque-controlled anchor, with an integral cone expander and single piece steel expansion clip providing 360-degree contact with the base material while not requiring oversized holes for installation and an impact section to prevent thread damage with required nuts and washers.
- C. Cartridge Injection Adhesive Anchors: An anchor system consisting of rod insert, nut, washer and a cartridge type, two-component polymer or hybrid mortar adhesive system dispensed and mixed through a static mixing nozzle supplied by the manufacturer.

1.5 SUBMITTALS

- A. Contractor's Statement of Responsibility Per Division 01 Section "Collective Inspections and Structural Testing"
- B. Product Data:
 - 1. Wedge Anchors
 - 2. Cartridge Injection Adhesive Anchors
- C. Research/Evaluation Reports:
 - 1. Submit ICC reports for the following:
 - a. Wedge Anchors
 - b. Cartridge Injection Adhesive Anchors

- D. Substitutions:
1. Substitution requests may only be made using products with ICC-ESR reports for the product in the specific substrate.
 2. Substitution request shall include signed and sealed calculations demonstrating that the product is capable of providing equivalent performance of the specified product for each specific location and condition when calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code.
 3. Substitution request shall specify the diameter and embedment depth of the substituted product
 4. Any increase in material labor cost resulting from the substitution shall be the responsibility of the contractor.
- E. Manufacturer's Instruction: Manufacturer's Installation Instructions
- F. Qualification Data: Submit installer qualification data as stated in Quality Assurance section. Qualifications shall be submitted in a letter format for each type of anchor to be installed, and shall include the following:
1. The specific product to be used
 2. Complete description of installation procedure
 3. Personnel to be trained on anchor installation
 4. Date of Manufacturer training
 5. Manufacturer's training certificates or letter from manufacturer certifying training was complete with a list of individuals that were trained.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: The installer shall be experienced in installing anchors equal to type, and into the substrate material required for this project
- B. Installer Training: Conduct a thorough training session with the manufacturer's representative. Each individual responsible for the installation of anchors shall attend the training session. Training shall consist of a review of the complete process for the installation of the anchors and the use of proper equipment for drilling and installing the anchors, to include but not limited to:
1. Hole drilling procedure. Clarify acceptability of rotary hammer drilling and/or core drilling.
 2. Hole drilling equipment
 3. Type and diameter of drill bits
 4. Hole preparation and hole cleaning technique
 5. Hole cleaning equipment
 6. Adhesive injection technique
 7. Adhesive injection equipment
 8. Anchor rod, nut and washer material requirements and associated cleaning requirements
 9. Anchor and Anchor rod installation
 10. Anchor tightening
 11. Adhesive curing requirements
- C. Certifications: All anchors shall have an ICC ESR Evaluation report indicating conformance with the current applicable Acceptance Criteria for the building code applicable to the project.
- D. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Keep anchors, rod materials, nuts and washers in manufacturer's packaging with label intact until needed for use.
- B. Keep anchors free of dirt and debris.
- C. Store anchors in a clean dry area

- D. Protect anchors from corrosion and deterioration.
- E. Store anchors and adhesives in strict accordance with manufacturer's requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Nuts: Having a proof load stress equal or greater than the minimum tensile strength of the associated anchor where type and strength is not specifically indicated by anchor or adhesive manufacturer.
- B. Washers: Of type and material compatible with nuts unless specifically indicated by anchor or adhesive manufacturer.
- C. Plate Washers: Provide ASTM A 36 plate washers of size and configuration specifically indicated.

2.2 CORROSION RESISTANCE

- A. Anchors and Anchor Bodies
 - 1. Uncoated Carbon Steel: Carbon steel anchors uncoated and free from oil, lubricants and other deleterious substances. Acceptable for use as follows:
 - a. Interior dry conditions
 - 2. Zinc Plated: Zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1) Acceptable for use as follows:
 - a. Interior dry conditions
 - 3. Hot Dip Galvanized: Carbon steel anchors with hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
 - a. Interior dry conditions
 - b. Exterior conditions
 - c. Anchoring galvanized steel elements
 - 4. Stainless Steel: AISI Type 316 stainless steel and complying with ASTM F 593. Acceptable for use as follows:
 - a. Anchoring treated lumber elements
 - b. Anchoring stainless steel elements
 - c. Anchoring aluminum elements or in contact with aluminum elements.
- B. Nuts
 - 1. Uncoated carbon steel: Acceptable for use as follows:
 - a. With Uncoated Anchors
 - 2. Hot Dip Galvanized: Hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
 - a. With Zinc Plated Anchors
 - b. With Hot Dip Galvanized Anchors
 - 3. Stainless Steel: ASTM F594. Acceptable for use as follows:
 - a. With Stainless Steel Anchors
- C. Washers
 - 1. Uncoated carbon steel: Acceptable for use as follows:
 - a. With uncoated anchors
 - 2. Hot Dip Galvanized: Hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
 - a. With Hot Dip Galvanized Nuts
 - 3. Stainless Steel: AISI Type 316 stainless steel. Acceptable for use as follows:
 - a. With Stainless Steel Nuts
- D. Plate Washers:
 - 1. Uncoated carbon steel: Acceptable for use as follows:
 - a. With Uncoated Nuts

2. Hot Dip Galvanized: Hot-dipped galvanized in accordance with ASTM A 153. Acceptable for use as follows:
 - a. With Hot Dip Galvanized Nuts

2.3 WEDGE ANCHORS

- A. Provide anchors with length identification markings conforming to ICC-ES AC01 or ICC-ES AC193 as appropriate based on the anchor substrate..
- B. Size: As indicated on drawings
- C. Embedment depth: As indicated on the drawings but not less than the manufacturer's documented minimum embedment depth. Where not specifically indicated use manufacturer's minimum documented embedment depth.
 1. Embedment depth is from surface of concrete or masonry. Anchor lengths and extent of threads shall account for embedment depth, connected elements, plate washers, washers, nut and appropriate stick thru.
- D. Concrete Anchors:
 1. Anchors shall be tested in accordance with ACI 355.2 and the most recent issue of ICC-ES AC193 including the following:
 - a. All mandatory testing
 - b. Shear and tension in cracked concrete.
 - c. Critical and minimum edge distances and spacing
 2. Anchors design shall be in accordance with ACI 318 Chapter 17
 3. Where not specifically indicated otherwise in contract documents or approved performance based shop drawings submittal anchors shall be as follows:
 - a. Hilti Kwik Bolt TZ with nut and washer, of required finish, ICC ESR-1917
 - b. Approved equal (See substitution requirements)
- E. Masonry Anchors:
 1. Anchors for masonry shall be tested in accordance with most recent edition of ICC-ES AC01 including the following
 - a. All mandatory testing
 - b. Seismic tension and shear
 - c. Critical and minimum edge distances and spacing
 2. Anchors design shall be in accordance with ACI 530
 3. Where not specifically indicated otherwise in contract documents or approved performance based shop drawings submittal anchors shall be as follows:
 - a. Hilti Kwik Bolt 3 with nut and washer, of required finish, ICC ESR-1385.
 - b. Approved equal (See substitution requirements)

2.4 CARTRIDGE INJECTION ADHESIVE ANCHORS

- A. Provide anchors with length identification markings conforming to ICC-ES AC58 or ICC-ES AC308.
- B. Size: As indicated on drawings
- C. Embedment depth: As indicated on the drawings but not less than the manufacturer's documented minimum embedment depth. Where not specifically indicated use manufacturer's minimum documented embedment depth.
 1. Embedment depth is from surface of concrete or masonry. Anchor lengths and extent of threads shall account for embedment depth, connected elements, plate washers, washers, nut and appropriate stick thru.
- D. Adhesive: Two component epoxy or two component hybrid system.
- E. Concrete Anchors:
 1. Anchors shall be tested in accordance with the most recent issue of ICC-ES AC308 including the following:
 - a. All mandatory testing
 - b. Shear and tension in cracked concrete.

- c. Critical and minimum edge distances and spacing
- 2. Anchors design shall be in accordance with ACI 318 Chapter 17 as amended by the specific design provisions of ICC-ES AC308
- 3. Where not specifically indicated otherwise in contract documents or approved performance based shop drawings submittal anchors shall be as follows:
 - a. Rods, washers, and nuts of required finish with Hilti HIT RE 500 V3 Adhesive Anchorage System for anchorage to concrete, ICC ESR-3814.
 - b. Rods
 - 1) Carbon Steel Rods: ASTM A193 B7 coated as required for use
 - 2) Stainless Steel Rods: ASTM F593, CW
 - c. Approved equal (See substitution requirements)
- 4. Where Hilti HIT-HY 200, ICC ESR-3187 system is specifically indicated in contract documents or approved performance based shop drawings submittal anchors shall be as follows:
 - a. For anchors 3/8" to 3/4" diameter: HIT-Z Standard or HIT-Z-R SS rods, washers, and nuts of required finish.
 - b. Approved equal (See substitution requirements)
- F. Masonry Anchors:
 - 1. Anchors for masonry shall be tested in accordance with most recent edition of ICC-ES AC58 including the following
 - a. All mandatory testing
 - b. Seismic tension and shear
 - c. Critical and minimum edge distances and spacing
 - 2. Anchors design shall be in accordance with ACI 530
 - 3. Where not specifically indicated otherwise in contract documents or approved performance based shop drawings submittal anchors shall be as follows:
 - a. Grouted Masonry: HAS-E Standard or HAS SS rods, washers, and nuts of required finish with Hilti HIT HY 270 Adhesive Anchorage System for anchorage to masonry, ICC ESR-4143.
 - b. Approved equal (See substitution requirements)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 2. Installation constitutes acceptance of existing conditions and responsibility of satisfactory performance.

3.2 INSTALLATION, GENERAL

- A. Corrosion Resistance: Care shall be taken to ensure an anchor and associated accessories of the proper material and associated corrosion resistance are used for the specification application. See corrosion resistance requirements above.
- B. Where manufacturer recommends the use of special tools for installation of anchors, such tools shall be used.
- C. Match mark and drill, match drill or use other methods to ensure anchors are properly located.
- D. Do not adjust anchor location after installation. Coordinate with EOR for modifications to connected element where anchors are incorrectly located.
- E. All facets of hole drilling, hole cleaning, anchor installation, anchor torqueing shall be in strict accordance with the ICC-ESR report and manufacturer's data.
- F. Drill holes perpendicular to substrate surface.
- G. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits as indicated in the ICC-ESR report.

- H. Drill bits and core bits shall be of diameters indicated in the ICC-ESR report.
- I. All holes shall be cleaned with compressed air to remove all drilling dust and other deleterious substances.
- J. Remove water from holes to attain a surface dry condition unless specifically permitted otherwise by ICC-ESR report.
- K. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- L. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
- M. Perform anchor installation in strict accordance with manufacturer instructions and ICC-ES report.
- N. Anchors shall be installed perpendicular to the substrate face within plus or minus 5 degrees unless specifically permitted otherwise by ICC-ESR report.
- O. Install plate washers where specifically indicated or where connected elements have oversized holes.
- P. Install a round washer under nuts. Round washers are in addition to plate washers where plate washers are required.

3.3 WEDGE ANCHORS

- A. Protect threads from damage during anchor installation.
- B. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

3.4 CARTRIDGE INJECTION ADHESIVE ANCHORS

- A. Clean all holes per manufacturer instructions using manufacturer's approved tools to remove loose material and drilling dust prior to installation of adhesive.
- B. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- C. Follow manufacturer recommendations to ensure proper mixing of adhesive components.
- D. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface.
- E. Remove excess adhesive from the surface.
- F. Shim anchors with suitable device to center the anchor in the hole.
- G. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- H. Observe manufacturer recommendations with respect to installation temperatures.
- I. Hilti HIT-HY200 system anchors shall be installed using the Hilti Safe Set Technology.
 - 1. For conditions using HAS rods the Hilti hollow drill bit and Hilt vacuum system shall be employed.

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with

the Contract Documents.

- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.
- B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 051200**STRUCTURAL STEEL FRAMING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Architecturally Exposed Structural Steel
 - 3. Nonshrink Grout.
- B. Products furnished, but not installed under this Section:
 - 1. Anchor rods with setting templates and embed plates indicated to be cast into cast-in-place concrete, installed under Division 03 Section "Cast-in-place-Concrete"
- C. Related Sections:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Post Installed Structural Anchors" for wedge, and adhesive anchors
 - 3. Division 09 painting Sections for special surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges" and as modified herein.
- B. Architecturally Exposed Structural Steel (AESS): Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1.5 SUBMITTALS

- A. Contractor's Statement of Responsibility Per Division 01 Section "Collective Inspections and Structural Testing"
- B. Fabricator's Certificate of Compliance Per Division 01 Section "Collective Inspections and Structural Testing"
- C. Quality Control Plan: Job specific Quality Control Plan for Fabricator and Erector including qualification data for the following:
 - 1. Fabricator
 - a. Testing personnel.
 - b. Inspection personnel
 - 2. Erector
 - a. Inspection personnel
- D. Shop Drawings: Show fabrication of structural-steel components.
 - 1. All anchor rods shall be detailed with a minimum 3" projection above top of nut in the final installed condition unless noted otherwise.
 - 2. Include min. 1/8" anchor rod setting templates. Detail quantity of templates such that there is one template for each bolt group. (Templates should not be reused).
 - 3. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 4. Splice members where indicated in the contract documents and as required to facilitate fabrication and erection. Coordinate splice locations within the limitations of referenced

- standards subject to approval of the Engineer of Record.
5. Include embedment drawings showing plan location and elevation of all embedded items.
 6. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 7. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 8. Include scale drawings of all gusset plates.
 9. Provide minimum 1/4" thick cap plates at the ends of all exposed HSS members, and at the top of all HSS columns.
 10. Equally space filler beams or joists between columns and/or other dimensioned beams unless noted otherwise.
 11. Where delegated design submittals are required the delegated design submittal must be included with associated shop drawings or the submittal will not be reviewed.
- E. Welding certificates
1. Submit welding certificates for all individuals expected to be performing field welding

1.6 QUALITY ASSURANCE

- A. Quality Control Plan: Each fabricator and Erector shall provide a job specific Quality Control plan.
1. The plan shall specifically identify all QC and QA inspections the fabricator and erector will be completing, the frequency of those inspections and the contractor's personnel and/or contractor's testing agency that will be completing the specific inspections.
 2. AISC Code of Standard Practice
 3. The plan shall comply with AISC 360 chapter N modified as follows:
 - a. 100% UT of CJP groove welds without reduction.
 4. The plan shall comply with AWS D1.1
 5. The plan shall comply with the requirements of AISC 341 Chapter J,
 6. The plan shall comply with AWS D1.8.
 7. The plan shall include any additional inspections or testing identified in the contract documents.
- B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU (Certified Building Fabricator) and which employs personnel or an independent testing agency that are qualified to complete all the required inspections and testing. Personnel shall be qualified as required by AWS D1.1 where completing weld testing and inspection.
1. Fabricator Responsibility
 - a. The structural steel fabricator shall be responsible for enlisting the Steel Deck fabricator for steel deck bearing on structural steel or steel joists as a direct subcontractor.
 - b. The structural steel fabricator shall be responsible for enlisting the steel erector as a direct subcontractor.
 - c. The structural steel fabricator shall be responsible for enlisting the steel deck erector for steel bearing on structural steel or steel joists as a direct subcontractor.
- C. Fabricator's Testing Agency (as required to supplement fabricator personnel): An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated. Personnel shall be qualified as required by AWS D1.1 where completing weld testing and inspection.
- D. Structural Steel and Architectural Structural Steel Installer Qualifications: The erector shall be experienced in installing structural steel equal in material, design and scope to the structural steel required for this project.
- E. Post Installed Structural Anchor Installer: See specification section 050520 for requirements
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M,

"Structural Welding Code - Steel."

- G. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
 2. AISC 360-16.
 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation. Provide min. 1/8" thick setting template for anchor rods.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes and Tees: ASTM A 992.
- B. Channels, Angles-Shapes:
1. ASTM A 36 unless noted otherwise
 2. ASTM A 572/A 572M, Grade 50 where indicated.
- C. Plate and Bar:
1. ASTM A 36 unless noted otherwise
 2. ASTM A 572/A 572M, Grade 50 where indicated.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.
1. Square or Rectangular HSS: $F_y=50$ KSI
 2. Round HSS: $F_y=46$ KSI
- E. Welding Electrodes:
1. Comply with AWS D1.1 requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125 Grade A325 or Grade A490 as indicated or as required, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.
1. Finish:
 - a. Unprimed, Primed or painted steel: Plain
 - b. Hot Dip Galvanized Steel:
 - 1) Bolts
 - a) Grade A325: ASTM F 2329 Hot-dip zinc coating
 - b) Grade A490: ASTM F 1136 Grade 3 Zinc/Aluminum Coating

- 2) Nuts: ASTM F2329 Hot-dip zinc coating
 - 3) Washers: ASTM F2329 Hot-dip zinc coating
 - 4) Plate Washers: ASTM A123 Hot-dip zinc coating
- B. Unheaded Anchor Rods
- 1. ASTM F1554 of Grade and associated supplements as indicated and as follows:
 - a. Grade 36, Supplement S3
 - b. Grade 55 with supplements S1 (weldable) and S3
 - c. Grade 105 with supplement S3
 - 2. Configuration: Straight.
 - 3. Nuts: ASTM A 563 heavy hex carbon steel.
 - 4. Plate Washers: ASTM A 36 carbon steel UNO, ASTM A 572 Grade 50 where indicated.
 - 5. Washers: ASTM F 436 hardened carbon steel.
 - 6. Finish:
 - a. Unprimed, Primed or painted steel: Plain
 - b. Hot Dip Galvanized Steel:
 - 1) Rod: ASTM F 2329 Hot-dip zinc coating
 - 2) Nuts: ASTM F2329 Hot-dip zinc coating
 - 3) Washers: ASTM F2329 Hot-dip zinc coating
 - 4) Plate Washers: ASTM A123 Hot-dip zinc coating
- C. Threaded Rods: ASTM A 36 unless noted otherwise.
- 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: ASTM A 36/A 36M carbon steel.
 - 3. Finish:
 - a. Plain for unprimed steel or steel receiving standard shop primer.
 - b. Hot-dip zinc coating, ASTM A 153/A 153M, Class C for hot galvanized steel or steel to receive high performance top coating.
- D. Post Installed Structural Anchors: See specification section 055020 for products

2.3 PRIMER

- A. Standard Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
 - 1. Typical all primed steel unless noted otherwise
- B. Special Primer: Provide shop primer that complies with Division 09 painting Sections.

2.4 PAINT

- A. Column Base Paint: A single component, self-priming cold applied Coal Tar Mastic suitable for corrosion protection of below grade steel.
 - 1. Typical at column bases at exterior locations and/or as specifically noted on drawings.
- B. Galvanizing Repair Paint: ASTM A 780.

2.5 NONSHRINK GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-

priming operations.

- B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 - 1. All Architecturally Exposed Structural Steel shall be classified as "Feature Elements" (AESS 2 or AESS 3) unless specifically identified as "Basic Elements" (AESS 1) in the contract documents.
 - 2. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 3. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of deformed bar anchors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- J. BUCKLING RESTRAINED BRACES
 - 1. Splices in steel cores are not permitted
 - 2. Assemble components of the BRB's in a manner to ensure proper performance of the brace.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type:
 - a. Snug tightened unless noted otherwise
- B. Weld Connections:
 - 1. Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
 - 3. Architecturally Exposed Structural Steel: Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.

- b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.8 CLEANING

- A. Clean and prepare steel surfaces that are to receive standard primer according to SSPC-SP 3, "Power Tool Cleaning."
- B. Clean and prepare steel surfaces that are AESS or are to receive special primer according to the associated painting specification. When not specifically noted the minimum cleaning shall be SSPC-SP 6, "Commercial Blast Cleaning."

2.9 STANDARD PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Top flanges of beams to receive field welded headed studs
- B. Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- C. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- D. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.10 SPECIAL PRIMING:

- A. All steel located in exterior spaces shall be shop primed per Division 09 Section "High Performance Coatings", "Exterior Painting"
- B. All steel located in interior spaces but to remain exposed shall be shop primed per Division 09 Section Interior Painting
- C. All architecturally exposed structural steel in interior spaces shall be shop primed per Division 09 Section Interior Painting
- D. All architecturally exposed structural steel located in exterior spaces shall be shop primed per Division 09 Section "High Performance Coatings", "Exterior Painting"
- E. Priming of steel noted as architecturally exposed structural steel shall be done with extreme care to avoid drips and runs.

2.11 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that will be exposed to the environment or that will be exposed in the finished work by plugging with zinc solder and filing off smooth.
 - 2. Galvanize loose and hung lintels, shelf angles, all exposed exterior steel and all steel located in exterior masonry walls unless noted otherwise. Coordinate with drawings and specifications.
 - a. Galvanized elements to be top coated shall not be quenched, and shall be swept blast to ensure proper adhesion of top coats.

2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections

2. The cost for reinspecting deficient work shall be the responsibility of the fabricator
- B. All source quality control and source quality assurance shall be completed by the fabricator's qualified personnel and/or the fabricator's qualified testing agency and shall be in accordance with the submitted and approved job specific quality control manual.
 1. Additional weld inspections as noted herein or in the contract documents.
 2. Payment for shop testing and inspection shall be the responsibility of the fabricator.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M.
- F. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified as-built survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Where ungrouted anchor rod sleeves are required caulk the annular surface between the sleeve and the anchor rod to prevent grout from entering the sleeves.
 2. Set plates for structural members on wedges, shims, or setting nuts as required. All shims shall be steel material.
 3. Weld plate washers to top of baseplate as indicated.
 4. Snug-tighten anchor rods after supported members have been positioned and plumbed.
 5. Bearing plates and loose column base plates shall be grouted and cured prior to erecting the steel to be supported by the plate
 6. Base plates attached to columns shall be grouted as soon as possible after the column has been plumbed. Base plates shall be grouted and cured before any elevated slabs are cast or before any column splices are made.
 7. Prior to grouting all loose and latent material shall be removed from bearing surfaces and base or bearing plates. Concrete or masonry surfaces shall be broom clean. All shims or wedges shall be left in place and cut flush to the edge of the base or bearing plate.

8. Grout shall be placed solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation and curing instructions for shrinkage-resistant grouts.
 - a. Use grout forms and grout surcharging as required to ensure that grout completely fills the space below bearing or base plate, and no voids remain.
9. Paint base plates, anchor bolts and sections of columns below grade and below finished floor with Coal Tar Mastic Paint when indicated on drawings.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- F. Splice members only where indicated on approved shop drawings.
- G. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- H. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- I. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
 1. For slip critical connections enlarge hole to next standard hole size and provide next standard bolt size.
- J. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- K. Shelf Angles anchored to steel frame:
 1. Sequencing of shelf angle installation shall be as indicated in drawings
 2. Unless noted otherwise do not permanently attach shelf angles until concrete slabs have been poured and cured.
 3. Once slabs have been poured and cured coordinate final elevation of shelf angle with contract documents and masonry contractor and permanently fasten.
- L. Pour stops and edge angles: Pour stops and edge angles shall be field installed based on global building control lines to ensure overall building geometry is maintained.
 1. Do not located based on local member geometry.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: As indicated on shop drawings.
- B. Finger Tight Bolts: All joints noted as finger tight shall be hand tightened as required to install elements. Do not tighten by mechanical means
 1. Provide jam nuts to prevent nut from backing off.
 2. After initial tightening turn nut and jam nut in opposite direction to bind them against one another.
- C. Weld Connections:
 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
4. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
5. Architecturally Exposed Structural Steel: Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

D. Post Installed Structural Anchors: See specification section 050520 for products

3.5 FIELD PAINTING

- A. Column bases: Paint column bases below grade and/or below finished floor at exterior conditions and/or conditions specifically noted on drawings with column base paint.
 1. Apply in strict accordance with manufacturer's recommendations
 2. Apply multiple coats as required by manufacturer, but not less than two individual coats allowing proper dry time between coats.
- B. Field painting of structural steel for finished appearance in exposed conditions or for high performance coating systems is specified in Division 09 painting sections.

3.6 FIELD QUALITY CONTROL

- A. The erector shall complete Field Quality control in accordance with AISC 360 Chapter N
- B. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements when the work was deemed deficient upon initial testing or inspection.

3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
 1. The coating thickness for zinc-rich paint repairs must be 50% higher than the surrounding coating thickness, but not less than 2.0 mils and not greater than 4.0 mils.
 2. The repaired surface should be free of lumps, coarse areas and loose particles
- B. Touchup Painting: At all exterior and exposed interior conditions promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 2. Apply a primer of same type as shop primer used on adjacent surfaces. Coordinate with Part 2 priming requirements

END OF SECTION

**SECTION 05 31 00
STEEL DECKING****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Composite floor deck.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 3. Division 05 Section "Structural Steel Framing" for framing deck openings with miscellaneous steel shapes.
 - 4. Division 09 painting Sections for field painting of primed and galvanized deck.

1.03 PERFORMANCE REQUIREMENTS:

- A. Deck Fastening Systems: The basis of design for the deck fastening systems is outlined in this specification and the contract documents. Product substitutions must result in diaphragm shear strength, and uplift resistance capacities equal or greater than values calculated for each specific condition. The baseline strength shall be calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code. See requirements for substitution submittals.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Mechanical fasteners
 - 2. Powder Actuated Fasteners
- B. Contractor's Statement of Responsibility Per Division 01 Section "Collective Inspections and Structural Testing"
- C. Quality Control Plan: Job specific Quality Control Plan for the Steel Deck Erector
- D. Shop Drawings: Submit detailed layout showing placement extent of each type of deck including the following:
 - 1. Coordinate layout with approved Engineered cold-formed metal trusses and Steel joist shop drawings
 - 2. Anchorage pattern for each type of deck and each anchorage condition
 - 3. Details for flat sump pans and associate anchorage
 - 4. Details of hip, ridge and valley plates and associated anchorage
 - 5. Details of cover plates and associated anchorage and changes in deck direction.
 - 6. Details of end jointed conditions
 - 7. Details of side lap conditions.
 - 8. Details of girder fills
 - 9. Details of finish/filler strips
 - 10. Details of pour stops
- E. Product Certificates: For each type of steel deck, signed by product manufacturer.
- F. Welding certificates.
 - 1. Submit welding certificates for all individuals expected to be performing field welding
- G. Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code -Steel" and AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.
 - 3. Supplement standard WPS with parameter for time per weld for each size of weld.
- H. Substitution for Deck Fastening Systems:

1. Substitutions to a welded fastening system in lieu of powder actuated fastening system will not be permitted except as specifically noted.
2. Substitution requests may only be made using products with ICC-ESR reports for the product indicating approval for use of the product in the specific condition existing on this project.
3. Substitution requests shall include signed and sealed calculations demonstrating that the product is capable of providing equivalent performance of the basis of design product for each specific location and condition when calculated using the referenced ESR report and in accordance with the appropriate design procedure and standards required by the building code.
4. An increase in material or labor cost resulting from the substitution shall be the responsibility of the contractor.

1.05 QUALITY ASSURANCE

- A. Quality Control Plan: Each deck erector shall provide a job specific Quality Control Plan.
 1. The plan shall specifically identify all QC and QA inspections erector will be completing, the frequency of those inspections and the erector's personnel and/or erector's testing agency that will be completing the specific inspections.
 2. The plan shall comply with the latest edition of the SDI "Standard for Quality Control and Quality Assurance for Installation of Steel Deck".
- B. Manufacturer Qualifications: A manufacturer certified by SDI to manufacture steel deck complying with applicable standard specifications and load tables of SDI "Specifications".
 1. The Manufacturer for steel deck bearing on structural steel or steel joists shall be act as a direct subcontractor of the structural steel fabricator.
 2. Manufacturer's responsibilities include providing professional engineering services for designing deck to comply with performance requirements.
- C. Erector Qualifications: The erector shall be experienced in installing steel deck equal in material, design and scope to the steel deck required for this project.
 1. The steel deck erector for steel deck bearing on structural steel or steel joists shall act as a direct subcontractor of the structural steel fabricator.
- D. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel" and AWS D1.3, "Structural Welding Code - Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- G. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- H. SDI Specifications:
 1. Form Deck shall comply with ANSI/SDI NC-2010, "Standard for Non-Composite Floor Deck", or latest adopted edition of the standard.
 2. Roof Deck shall comply with ANSI/SDI RD-2010, "Standard for Steel Roof Deck", or latest adopted edition of the standard.
 3. Composite Steel Deck shall comply with ANSI/SDI-C1.O-2006, "Standard for Composite Steel Floor Deck", or latest adopted edition of the standard.
- I. Professional Engineering Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of the kind indicated.

- J. Powder Actuated Fastener Installer Training: Conduct a thorough training session with the manufacturer's representative. Each individual responsible for the installation of fasteners shall attend the training session. Training shall consist of a review of the complete process for the installation of the fasteners and the use of proper equipment for the installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.
- C. Store steel decking on supports off the ground
- D. Keep steel decking free of dirt and foreign matter.

1.07 COORDINATION

- A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 07 Section to ensure protection of insulation strips against damage from effects of weather and other causes.
- B. Coordinate layout of steel decking in areas of engineered cold-formed truss framing with approved truss shop drawings. Do not submit decking for these areas for approval until engineered cold-formed truss framing shop drawings have been approved. Prior to fabrication perform a final coordination with field use engineered cold formed metal truss framing shop drawings.
- C. Coordinate layout of steel decking in areas of steel joist framing with approved joist shop drawings. Do not submit decking for these areas for approval until steel joist shop drawings have been approved. Prior to fabrication perform a final coordination with field use engineered steel joist shop drawings.

PART 2 - PRODUCTS

2.01 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
 - 1. Type "2CFD18" (galvanized), "2CFD18G90" (special galvanized) and "2CFD18P" (galvanized and primed):
 - a. Galvanized Steel Sheet (2CFD18): ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating.
 - b. Galvanized Steel Sheet (2CFD18G90): ASTM A 653/A 653M, Structural Steel (SS), G90 zinc coating.
 - c. Galvanized and Shop-Primed Steel Sheet (2CFD18P): ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating; cleaned, pretreated, and bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - 1) Color: White.
 - d. Profile Depth: 2 inches
 - e. Properties as follows:
 - 1) Design Uncoated-Steel Thicknesses: 0.0474 inch
 - 2) Area (As):0.710 in²/ft

- 3) Moment of Inertia (I): 0.560 in⁴/ft
- 4) Section Modulus (Sp): 0.508 in³/ft
- 5) Section Modulus (Sn): 0.522 in³/ft
- 6) Yield Strength (Fy): 50 ksi

- f. Span Condition: Double span unless noted otherwise.
- g. Side Laps: Interlocking
- h. End Joints: Butted

2.02 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Powder Actuated Fasteners: Basis of design product as indicated on drawings. See requirements for substitution submittals. Where not specifically indicate the basis of design fasteners shall be Hilti fasteners in accordance with ICC ESR-2197.
- C. Mechanical Fasteners: Unless noted otherwise, ASTM C1513, corrosion-resistant coated, self-drilling, self-tapping steel drill screws. No. 10 minimum diameter unless noted otherwise.
- D. Side-Lap Fasteners: Unless noted otherwise, ASTM C1513, corrosion-resistant coated, self-drilling, self-tapping steel drill screws. No. 10 minimum diameter unless noted otherwise.
- E. Welding Electrodes: Comply with AWS standards.
- F. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, grade, thickness, and finish to match associated deck. Profile as required for application.
- G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated. Where not specifically indicated provide as recommended by SDI Publication No. 30 for overhang and slab depth.
 - 1. Provide a stiffened return lip on the vertical lip of all pour stops.
- H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, coordinate drain assembly opening requirements plus 6" all sides (minimum 24"x24") of same material and finish as deck. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: ASTM A 780.
- K. Repair Primer: Manufacturer's standard rust-inhibitive primer of same type and color as shop primer.
- L. Fastener Type Marking Paint: Easily identifiable canister spray paint

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 INSTALLATION, GENERAL

- A. In cases where varying type powder actuated fasteners are required each beam/joist support shall be marked with color coded "fastener type marking paint" to identify which fastener type is to be used at specific beam/joists.
- B. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide flat sump plates at all roof drains
- H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

- I. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- J. Mechanical Fasteners: Locate mechanical fasteners and install according to drawings, and the following requirements:
 - 1) Minimum edge distance and center to center spacing of fasteners shall be three fastener diameters unless noted otherwise.
 - 2) Minimum screw penetration shall leave at least 3 exposed threads on the backside of connection unless noted otherwise.

3.03 FLOOR-DECK INSTALLATION

- A. Fasten floor deck panels to steel supporting members as indicated.
 - 1. Do not install power actuated or other penetrating type fasteners in areas of protected zones.
 - 2. Where the typical fastening system consists of powder actuated or other penetrating type fasteners replace each fastener with one 5/8" diameter puddle weld unless noted otherwise for the extent of protected zones.
- B. Fasten floor deck side laps and perimeter edges as indicated.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Butted unless noted as lapped.
- D. Pour Stops and Girder Fillers: Fasten steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Fasten steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.04 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas of prime-painted deck immediately after installation, and apply repair primer.
 - 1. Apply repair primer, of same type and color as adjacent shop-primed deck.
- C. Protected Zone repairs: Where penetrating type fasteners are errantly installed in a protected zone the repair shall be completed by the structural steel erector. The deficiency shall be reported to the EOR and the EOR will provide direction on the removal of the fastener, the substrate repair, and an alternate fastener installed as directed by the EOR.

- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

**SECTION 06 10 00
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Wood nailers and blocking associate with roofing and parapets.
- C. Preservative treated wood materials.
- D. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.
- D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 ROOFING

- A. Framing Lumber: Nailers, framing edge strips, crickets, curbs, parapet blocking and cants.
 - 1. All wood shall be preservative treated.
- B. Grade of Lumber shall be No. 2 or better..

2.05 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.06 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with roofing, flashing, or waterproofing.
 - c. Treat lumber in contact with masonry or concrete.
 - d. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.03 WOOD ROOF NAILERS, EDGE STRIPS, CURBS, BLOCKING AND CANTS

- A. General:
 - 1. Provide sizes and configurations to match specific conditions at edge perimeters, curbs, and expansion joints.
 - 2. Thicknesses to match insulation thicknesses and minimum 2 x 6, unless specifically required otherwise.
 - 3. If multiple layers, attach each layer independently and minimum 1 1/2 inch thickness at top, when applicable.
- B. Wood Blocking Attachment
 - 1. Steel Substrate
 - a. A minimum 3/4 inch diameter bolt tapped into a structural member or into bar joists between 48 inches on center.

- b. Attachment to metal deck requires #12 fastener 12 inches on center and 6 inches on center at corners.
 - c. Provide separation of surfaces by means of waterproof underlayment.
 2. If other substrate/edge conditions exist, the Contractor shall provide attachment to resist 250 pounds per square linear foot in all directions and increased by 100% at corners.
 - a. This may require attachment to structural framing or adding secondary framing.
 - C. Nailers/Fasteners
 1. A 1/4 inch gap between nailers is required.
 2. Pre-drilled holes for attachment.
 3. Nails used to secure multiple nailers should be long enough to penetrate the base wood blocking 1 1/4 inch. A fastener shall be placed 3 inches from each end and double rows spaced 24 inches on center and staggered is required.
 4. Joints in nailers shall be staggered in multiple layer applications and shall have interlocked corners.
 5. Nails should be installed at angles.
 6. Nailers used to raise curbs of mechanical units, skylights and other penetrations shall be installed level.
 - D. Nailer Configurations
 1. Match nailer thicknesses with insulation thicknesses including tapered insulation.
 2. Stack nailers with joints staggered and plywood sandwiched between nailers.

3.05 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Cabinet hardware.
- C. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Laminate color and edge banding color samples.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Organ Platform Cabinets: Wood, Custom grade, Painted finish.
- D. Cabinets:
 - 1. Plastic Laminate Cabinet Style: Flush overlay.

202 LAMINATE MATERIALS

- A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

203 COUNTERTOPS

- A. Solid Surfacing: Specified in Section 12 36 00.

204 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.
- C. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

205 HARDWARE

- A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- B. Drawer and Door Pulls: Southern Hill brushed nickel pulls, SH3229-128-SN-5. 6.3 inch handle length, 5 inch screw hole spacing.
- C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
- D. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Commercial grade Heavy Duty grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
- E. Hinges: European style concealed self-closing type, steel with polished finish.

206 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

PART 3 EXECUTION

301 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements of custom grade installation.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.

3.03 ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, and parapet caps.

1.02 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 2013.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.
- F. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Aluminum: ASTM B209 (ASTM B209M); 0.032 inch thick; anodized finish of color as selected.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 0.032 inch thick; plain finish shop pre-coated with modified silicone coating.
 - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 - 2. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 - 3. Color: As selected by Architect from manufacturer's standard colors.

2.02 ACCESSORIES

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant: Type as specified in Section 07 90 05.
- E. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- G. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

END OF SECTION

**SECTION 07 90 05
JOINT SEALERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A Sealants and joint backing
- B Precompressed foam sealers

1.02 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2010.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.
- D. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Samples: Submit samples illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

- A. Sealants and Primers - General: Provide products having volatile organic compound (VOC) content.
- B. Type S1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
 - 1. Color: Match adjacent finished surfaces.
 - 2. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
- C. Type S2 - General Purpose Exterior Sealant: Acrylic, solvent release curing; ASTM C920, Grade NS, Class 12-1/2, Uses M, G, and A; single or multi- component.

1. Color: Match adjacent finished surfaces.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
- D. Type S3 - Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
 1. Face color: To be selected by architect.
 2. Size as required to provide weathertight seal when installed.
 3. Provide product recommended by manufacturer for traffic-bearing use.
 4. Applications: Use for:
 - a. Exterior wall expansion joints.
- E. Type S4 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
 1. Applications: Use for:
 - a. Concealed sealant bead in sheet metal work.
 - b. Concealed sealant bead in siding overlaps.
- F. Type S5 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
 1. Color: Match adjacent finished surfaces.
 2. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
- G. Type S6 - Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
 1. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker where joint backing is not used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- H. Tool joints concave.
- I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
- J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.
- K. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel frames for wood doors.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 08 14 16 – Flush Wood Doors
- B. Section 08 71 00 - Door Hardware.
- C. Section 09 90 00 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003 (R2008).
- D. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2011).
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- F. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).
- H. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.
- I. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.
- J. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- K. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with NAAMM HMMA 840.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 FRAMES

- A. Requirements for All Frames:
 - 1. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 2. Texture: Smooth faces.
 - 3. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
 - 4. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
 - 5. Galvanizing for Units in Wet Areas: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness
 - 6. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 STEEL FRAMES

- A. General:
 - 1. Comply with the requirements of grade specified for corresponding door.
 - a. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 2.
 - 2. Finish: Same as for door.
 - 3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
 - 4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

2.03 ACCESSORY MATERIALS

- A. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.
- B. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.04 FINISH MATERIALS

- A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Coordinate frame anchor placement with wall construction.
- B. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- C. Coordinate installation of hardware.
- D. Coordinate installation of glazing.

3.04 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.
- B. ICC (IBC) - International Building Code; 2012.
- C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.
- E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2012.
- F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- B. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.
 - 2. Include certification program label.
- C. Specimen warranty.
- D. Samples: Submit two samples of door veneer, 12 by 12 inch in size illustrating wood grain, stain color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 DOORS AND PANELS

- A. All Doors: See drawings for locations and additional requirements.
 - 1. Quality Level: Premium Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at all locations.
 - 2. Maple veneer facing with factory transparent finish.

2.02 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

2.03 DOOR FACINGS

- A. Wood Veneer Facing for Transparent Finish: Maple, veneer grade as specified by quality standard, plain sliced, book veneer match, running assembly match; unless otherwise indicated.
 - 1. Vertical Edges: Any option allowed by quality standard for grade.
 - 2. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.
- B. Facing Adhesive: Type I - waterproof.

2.04 ACCESSORIES

- A. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- B. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other through bolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
 - 1. Exception: Doors to be field finished.
- F. Doors shall be urea formaldehyde free.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:
 - 1. Transparent:
 - a. System - 12, Polyurethane, Water-based.
 - b. Stain: As selected by Architect.

- c. Sheen: Satin.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.
- F. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work under this section includes furnishing and the installation of finish and security hardware specified herein and noted on drawings for a complete and operational system, including any electrified door hardware components including finish and security hardware and auto operators for entrance doors.

Items include, but are not limited to:

1. Hinges/Continuous Hinges
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates - Pulls
6. Coordinators
7. Closers/ADA Operators
8. Kick, Mop and Protection Plates
9. Stops, Wall Bumpers, Overhead Controls
10. Thresholds, Gasketing and Door Bottoms
11. Silencers
12. Miscellaneous Trim and Accessories
13. Electrified Hardware Items, Controls and Power Supplies

B. RELATED SECTIONS:

1. Section 01 21 00 – Allowances
2. Division 06 – Carpentry
3. Section 08 11 13 – Hollow Metal Frames
4. Section 08 14 16 – Flush Wood Doors

1.02 REFERENCES

- A. The following references are used in this section.
1. NFPA 80 – Standard for Fire Doors, 2013.
 2. Installation Guide for Doors and Hardware, DHI, 1984.
 3. ANSI / BHMA A156.18, Materials and Finishes, 2006.

1.03 GENERAL REQUIREMENTS

- A. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

B. DESCRIPTION OF WORK

1.04 SUBMITTALS

- A. Hardware Schedule: Submit 5 copies of hardware schedule in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking.

- B. Hardware schedule shall clearly indicate architect's hardware group and manufacturer of each item proposed.
- C. The schedule shall be reviewed prior to submission by a certified Architectural Hardware Consultant (AHC), who shall affix his or her seal attesting to the completeness and correctness of the schedule.
 - 1. Provide 2 copies of illustrations from manufacturer's catalogs and data in brochure form.
 - 2. Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable or incompatible items and proposed substitutions in hardware schedule.
 - 3. Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.
 - 4. Furnish other Contractors and Subcontractors concerned with copies of final approved hardware schedule. Submit necessary templates and schedules as soon as possible to hollow metal, wood door, and aluminum door fabricators in accordance with schedule they require for fabrication.
 - 5. Samples: Lever design or finish sample: Provide 3 samples if requested by architect.
- D. Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish hardware. Send installation instructions to site with hardware.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
- F. Contract Closeout Submittals: Comply with Section 01700 including specific requirements indicated below.
 - 1. Operating and maintenance manuals: Submit 3 sets containing the following:
 - 2. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - 3. Catalog pages for each product.
 - 4. Name, address, and phone number of local representative for each manufacturer.
 - 5. Parts list for each product.
 - 6. Copy of final approved hardware schedule, edited to reflect "As installed".
 - 7. Copy of final keying schedule.
 - 8. As installed "Wiring Diagrams" for each opening connected to power, both low voltage and 110 volts.
 - 9. One complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.05 QUALITY ASSURANCE

- A. General Contractor's Investigation: Prior to Contract Execution, the General Contractor shall have thoroughly investigated the entities that will be performing work or supplying materials, products, equipment, or systems for this project, to ensure that they comply with all of the qualifications and requirements mentioned or implied in the Contract Documents. If it is later determined that any of the previously mentioned entities do not comply with the qualifications and requirements specified in the Contract Documents, the General Contractor will be required to replace that entity with a qualified entity at no increase in Contract Sum or Contract Time.
- B. Manufacturer: Obtain each type of hardware (ie. latch and locksets, hinges, closers) from single manufacturer, although several may be indicated as offering products complying with requirements.

- C. Qualifications of the Hardware Supplier: A recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the Project's vicinity for a period of not less than 4 years. The supplier shall be, or shall employ, an Architectural Hardware Consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about the Project's hardware requirements, to the Owner, Architect, and Contractor. An Architectural Hardware Consultant (AHC) shall prepare all hardware and access control schedules. This Supplier shall be responsible for proper coordination of all finish hardware items and access control items with related sections to insure compatibility of products.
 - 1. Hardware supplier must be an authorized, direct factory distributor of all door hardware products specified herein to insure compliance and service of these products.
 - 2. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.
- D. Qualifications of Installer: The hardware installer shall have documented experience in the installation of hardware of similar quantities and types as required for this project. The installer's qualifications shall be submitted to the architect, in writing, for approval by the architect before any work shall commence.
- E. Fire-Rated Openings: Furnish door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of the Authorities Having Jurisdiction. Furnish only items, of door hardware, that are listed and are identical to products tested by UL, ITS-WH, FM, or other testing and inspecting organization acceptable to the Authorities Having Jurisdiction, for use on types and sizes of doors indicated, in compliance with the requirements of fire-rated door and door frame labels.

Project requires door assemblies and components that are compliant with positive pressure and S Label requirements. Specifications must be cross-referenced and coordinated with door and frame manufacturers to ensure that total door opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.

Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels including "Fire Door to be Equipped with Fire Exit Hardware") provide UL/WHI or FM label on exit devices indicating "Fire Exit Hardware".

- F. Substitutions: All substitution requests are required to be submitted prior to the bid date and complying with the procedures and time frame as outlined in Division 01, General Requirements. Approval of submitted products is at the discretion of the architect and his hardware consultant.
 - G. At the Project's Completion, the Owner's Representative shall accompany the Architect and General Contractor during the Door Hardware and Access Control Items punch list phase of the project close-out, insuring the Owner's Representative is familiar with all applications and systems, as installed. Refer to additional requirements under 3.0 EXECUTION.
 - H. Pre-Installation Meeting: Prior to door hardware installation, the General Contractor / Construction Manager shall request a hardware installation meeting to be held at the project location. This meeting shall convene prior to the hardware's installation. The types of hardware this meeting shall include are: locksets, exit devices, and door closers. The manufacturer's representatives of the above listed products, in conjunction with the hardware supplier for this project, shall conduct the installation training. All hardware installers shall be required to attend this meeting to receive certificate of authorized training. This meeting shall serve as door openings coordination and review of all shop drawings from related trades prior to the hardware installation. The Hardware Supplier shall include any related meeting costs in their proposal.
- 1.06 DELIVERY, STORAGE AND HANDLING
- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
 - B. Packaging of door hardware is the responsibility of the supplier. As material is received by the hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set numbers to match the set numbers of the approved hardware schedule. Two or more identical sets may be packed in the same container.
 - C. The door hardware supplier shall deliver all individually packaged hardware items in a timely

fashion to the place of installation (Shop or Project Site); direct factory shipments are not acceptable unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor.

- D. The General Contractor, door hardware supplier, access control supplier, and installers shall count, coordinate, and store all door hardware and access control items herein, verifying complete counts of all items scheduled and furnished. The contractor must report all shortages (discrepancies with shipping documents) within five (5) working days. The manufacturers' and Owner's representatives will inspect the installation of the door hardware and access control items during that phase of construction. Any deficiencies in installation of all materials included herein shall be corrected before installation continues.
- E. The General Contractor shall provide a secure lock-up for the door hardware and security equipment delivered to the Project, but not yet installed. Control handling and installation of the hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.07 WARRANTY

- A. All materials must be warranted against defects in workmanship and materials for a period of one (1) year from date of acceptance of this project, unless otherwise noted. Any evidence of misuse or abuse voids all warranties. These warranties shall be each manufacturers' standard written warranty.
- B. Special Warranties:
 - 1. Continuous Geared Hinges: Life of the Door Opening.
 - 2. Mortise Latchsets and Locksets: Three (3) Year Period.
 - 3. Exit Devices: Three (3) Year Period.
 - 4. Door Closers: Thirty (30) Year Period.
 - 5. Electromagnetic Door Holders: Two (2) Year Period.
 - 6. Saddle Thresholds, Bumper Thresholds, Door Sweeps, Self-Adhesive Gasketing, Perimeter Seals, Astragal Seals, Self-Adhesive Astragal Gasketing, Mullion Seals, Interlocking Seals, and Drip Strips: Five (5) Year Period.
- C. Any manufacturer whose standard written warranty does not equal or exceed the requirements listed above must provide a letter stating that they will extend their warranty to comply with the requirements of this specification.
- D. All of the manufacturer's fasteners and attachments supplied with each hardware item must be installed to maintain the manufacturer's fire listing and/or warranty.
- E. Refer to Section 01 - Closeout Procedures for additional warranty requirements.

1.08 MAINTENANCE

- A. Maintenance Tools and Instructions: General Contractor shall furnish a complete set of specialized tools and maintenance instructions as needed for the Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.1 BUTTS AND HINGES

- A. Acceptable Manufacturers:

Ives	Bommer	Stanley
3CB1	LB8002	CB1900R
3CB1	LB8000	CB1960R
3CB1HW	LB8006	CB1901R
3CB1HW	LB8004	CB1961R
5BB1SCHW	BB5024	FBB268

5BB1	BB5000	FBB179
5BB1	BB5001	FBB191
5BB1HW	BB5004	FBB168
5BB1HW	BB5005	FBB199

B. Application:

1. Provide NRP (non-removable pins) at out-swinging lockable doors.

C. Quantity:

1. Two hinges per leaf for openings through 60 inches high.
2. One additional hinge per leaf for each additional 30 inches in height or fraction thereof.
3. Four hinges for Dutch doors up to 90 inches in height.

2.2 CONTINUOUS GEARED HINGES

A. Acceptable manufacturers:

Ives	Stanley	Select
112HD	661HD	SL11HD
210HD	665HD	SL21HD
224HD	662HD	SL24HD

- B. Provide electric power transfer (EPT) cutouts, or electric through-wire options as specified in hardware groups.

2.3 FLUSH BOLTS AND DUSTPROOF STRIKES

A. Acceptable manufacturers:

Ives	Trimco	Burns
FB31P	3810	7842
FB41P	3815	7942
FB51P	3820 x 3810	7845
FB61P	3825 x 3815	7945
FB358	3913	591
FB458	3915	590
DP2	3910	545

- B. Provide automatic and manual flush bolts with forged bronze face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. Top rods at manual flush bolts for doors over 90 inches in height shall be increased by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.

2.4 LOCKSETS – CYLINDRICAL – GRADE 1

A. Acceptable Manufacturer and Series:

Schlage	Corbin	Best
ND Series x SPA	CL3300 x NZD	93K x 14D

B. Provide lock functions specified in Hardware Groups, with following provisions:

1. Cylinders: Refer to "KEYING" article, herein.
2. Locks shall meet UL A label; to have a minimum listing for single doors 4' x 8'.
3. Locks shall have the ability to incorporate either a rigid or free-wheeling lever when in a locked mode.
4. Levers shall be bi-directional.
5. Levers shall be solid. Manufacturers utilizing lever fillers are not acceptable.
6. Furnish "Knurled" or "Tactile" outside levers as indicated in the door Hardware Sets. "Abrasive" outside levers shall not be acceptable.
7. Lockset adjustment plate shall be threaded for door thickness adjustment for doors 1 5/8" to 2 1/8" thickness. The adjustment plate shall have visual chassis marking for doors 1 3/4"

- thick.
8. Locks shall have field reversible handing.
 9. Latchbolt to be steel with minimum 1/2" throw latch; 3/4" throw latch on pairs of fire rated doors.
 10. Strikes shall have curved lip of sufficient length to clear trim.

2.5 EXIT DEVICES

A. Acceptable Manufacturers:

Von Duprin 98/99 Series	Detex Advantex Series	Precision Apex Series
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- B. Provide exit device series and functions as specified in Hardware Groups. Von Duprin product numbers are referenced in the Hardware Groups.
- C. All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be UL listed as "Fire Exit Hardware".
- D. Where lever trim is specified, provide lever design to match lockset levers.
- E. Provide lever trim with breakaway feature.
- F. Provide cylinders for exit devices with locking trim and cylinder dogging.
- G. Provide exit devices with stainless steel touch bars. Load bearing plastic parts are not acceptable.
- H. Provide exit devices with cast metal, flush end caps.
- I. Provide deadlocking latchbolt feature for exit devices.
- J. Provide roller strikes on all rim exit devices.
- K. Provide cylinder dogging feature for non-rated exit devices.
- L. Provide keyed removable mullions, with cylinders, as specified in the Hardware Groups.

2.6 KEYING

- A. Master key or Grand master key cylinders and key in groups, unless otherwise specified. Factory masterkey with manufacturer retaining permanent keying records.
- B. Provide 6 masterkeys for each masterkey set. Provide 3 change keys for each lock. Provide 2 control keys for core removal. Stamp keys "DO NOT DUPLICATE."
- C. Submit proposed keying schedule to Architect. If requested, meet with Owner and Architect to review schedule.
- D. Provide removable core cylinders, with patented key control, for each lock with temporary keyed brass construction cores. Permanent cores shall be installed upon completion of the project.

2.7 DOOR TRIM

A. Acceptable Manufacturers and Types:

Ives	Trimco	Burns
8200	1001-9	56
8303	1018-3B	5426C
9100	1741	422
8190	1191-3	29C
8103-0	1195-2	26C
8102-8	1194-2	25B

B. Push Plates:

1. Ives type 8200 6 inches by 16 inch unless otherwise indicated.
2. Where width of door stile prevents use of 6 inch wide plate, provide push plate one inch less than width of stile but not less than 4 inches wide.

C. Pull Plates:

1. Ives type 8303 4 inches by 16 inches unless otherwise indicated.

D. Push Bars:

1. Ives type 9100, unless otherwise indicated.

E. Pulls:

1. Ives Series 8190, unless otherwise indicated.
2. Where required, mount back to back with push bars.

F. Kick Plates and Armor Plates: Ives 8400 Series, minimum of 0.050 inch thick, beveled 4 edges.

1. At single doors provide width two inches less than door width on stop side and one inch less than door width on pull side.
2. At pairs of doors provide width one inch less than door width on both sides.
3. Height of 10 inches, unless otherwise indicated.
4. Provide plates with countersunk screw holes.

2.8 COORDINATORS

A. Acceptable Manufacturers:

Ives	Trimco	Burns
COR Series	3094 Series	7600 Series

B. Provide Ives COR Series coordinator for labeled pairs of doors equipped with automatic flush bolts and those with vertical rod/mortise lock fire exit device combinations with astragals.

C. Provide filler bars for total opening width, closer mounting brackets, carry bars, and special preparation for top latches where applicable.

2.9 DOOR CLOSERS

A. Acceptable Manufacturers and Types of Large Bore Exposed Closers:

LCN	Sargent	Norton
4050 Series	351 Series	7500 Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2 inch (38 mm) diameter, with 11/16 inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: not permitted.
8. Provide stick on and special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

B. Acceptable Manufacturers and Types of Medium Bore Exposed Closers:

LCN	Sargent	Norton
1450 Series	1331 Series	8501/8501BF Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter heat-treated pinion journal and full complement bearings.

4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: not permitted.
8. Provide stick on and special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.10 OVERHEAD STOPS

A. Acceptable Manufacturers

Glynn Johnson	Rixson	Sargent
450	10 Series	1540 Series
410	5 Series	1530 Series
90	9 Series	590 Series
100	1 Series	690 Series

- B. Provide overhead stops for interior doors equipped with regular arm surface type closer for doors that open against equipment, casework, sidelights, other objects that would make wall stops inappropriate.
- C. Provide sex bolt attachments for mineral core door application.

2.11 WALL STOPS AND HOLDERS

A. Acceptable Manufacturers and Types:

Ives	Trimco	Door Controls
WS406/407CVX	1270WXCP	3211
WS406/407CCV	1270WVP	3211T
WS445	1207	3267X
FS436	W1211	3310X
WS40	1254	3487X

- B. Provide WS406/407CCV Series wall stop for each door leaf unless otherwise specified, or where conditions require the use of an overhead stop.
- C. Floor or base stops shall be used only where definitely specified or absolutely unavoidable.

2.12 THRESHOLDS

A. Acceptable Manufacturers and Product:

National Guard	Reese	Zero
425E	S425A	8655A

- B. Where thresholds are specified in hardware groups, provide 425E thresholds unless detailed otherwise.
- C. Refer to drawings for special details. Provide accessories, shims and fasteners.
- D. Where thresholds occur at openings with one or more mullions, they shall be cut for the mullions and extended continuously for the entire opening.

2.13 WEATHERSTRIPPING

A. Acceptable Manufacturers and Product:

Sweeps	National Guard	Reese	Zero
	201NA	323C	39A

Jambs	700SA	755C	429A
Rain Drips	16A	R201C	142A

- B. Where weatherstripping is specified in hardware groups, provide 700SA unless detailed otherwise.
- C. Provide self-tapping fasteners for weatherstripping being applied to hollow metal frames.
- D. Where sweeps are specified in hardware groups, provide 201NA unless detailed otherwise.
- E. Where rain drips are specified in hardware groups, provide 16A x full frame width, unless detailed otherwise.

2.14 GASKETING

- A. Acceptable Manufacturers:

National Guard	Reese	Zero
5050	F-797B	188S
5020	638	488S

- B. Where smoke gasket is specified in hardware groups, provide 188S, unless detailed otherwise.
- C. Provide gaskets for 20-minute doors and doors designated for smoke and draft control.
- D. Where frame applied intumescent seals are required by the manufacturer, provide gaskets that comply with UBC 7-2, 1997 and UL 10C positive pressure tests.

2.15 DOOR POSITION SWITCHES

- A. Acceptable Manufacturers and Types:

Schlage	Sentrol
679-05HM	1078W
679-05WD	1078W
674-OH	2202

- B. Coordinate door and frame preparations with door and frame suppliers.
- C. Switches shall be installed in frame head approximately 4" from latching door edge.

2.16 PIR MOTION SENSORS

- A. Acceptable Manufacturers and types:

Schlage
SCAN II-W

- B. Provide motion sensors as specified in hardware groups.

2.17 SILENCERS

- A. Acceptable Manufacturers and types:

Ives	Steelcraft	Don-Jo
SR64	Q146	1608

- B. Provide grey rubber silencers featuring pneumatic design that, once installed, forms an air pocket to absorb shock and reduce noise of door closing.
- C. Provide three (3) silencers per hollow metal strike jamb; two (2) per hollow metal double door head. Omit at doors scheduled to receive perimeter weatherstripping or smoke gasket.
- D. Silencers shall meet ANSI/BHMA A156.16, L03011

2.18 FASTENERS

- A. Including, but not limited to, wood or machine screws, bolts, nuts, anchors, etc. of proper type, material, and finish required for installation of hardware.
- B. Use phillips head for exposed screws. Do not use aluminum screws to attach hardware.
- C. Provide self-tapping (TEC) screws for attachment of sweeps and stop-applied weatherstripping only.

2.19 TYPICAL FINISHES AND MATERIALS

- A. Finishes, unless otherwise specified:
 - 1. Butts: Outswinging Exterior Doors
 - a. US32D (BHMA 630) on Stainless Steel
 - 2. Butts: Interior Doors and Inswinging Exterior Doors
 - a. US26D (BHMA 652) on Steel
 - 3. Continuous Hinges:
 - a. US28 (BHMA 628) on Aluminum
 - 4. Flush Bolts:
 - a. US26D (BHMA 626) on Brass or Bronze
 - 5. Exit Devices:
 - a. US26D (BHMA 626) on Brass or Bronze
 - 6. Locks and Latches:
 - a. US26D (BHMA 626) on Brass or Bronze
 - 7. Push Plates, Pulls and Push Bars:
 - a. US32D (BHMA 630) on Stainless Steel
 - 8. Coordinators:
 - a. USP (BHMA 600) on Steel
 - 9. Kick Plates, Armor Plates, and Edge Guards:
 - a. US32D (BHMA 630) on Stainless Steel
 - 10. Overhead Stops and Holders:
 - a. US26D (BHMA 626) on Brass or Bronze
 - 11. Closers: Surface mounted.
 - a. Sprayed Aluminum Lacquer.
 - 12. Latch Protectors:
 - a. US32D (BHMA 630) on Stainless Steel
 - 13. Miscellaneous Hardware:
 - a. US26D (BHMA 626) on Brass or Bronze

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine doors, frames, and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

3.2 INSTALLATION

- A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with governing regulations and, except as otherwise indicated, by the Architect.
 - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 09 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

- C. Sets units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Where scheduled, door pulls shall be through-bolted with bolt heads concealed behind push plates.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds, for exterior and interior doors, in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 07 - Joint Sealers.
- G. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.
- H. The hardware installer shall be responsible for installation of all mechanical and electromechanical hardware items contained within this specification, in accordance with the manufacturer's technical installation guidance, and in addition to all applicable code requirements.

3.3 FIELD QUALITY CONTROL

- A. After installation has been completed, provide services of qualified hardware consultant to check Project to determine proper application of finish hardware according to schedule. Also check operation and adjustment of hardware items.
- B. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 ADJUSTING AND CLEANING

- A. At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to door closers and other items of hardware. Where hardware is found defective repair or replace or otherwise correct as directed.
- B. Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors.
- D. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.
- E. Clean adjacent surfaces soiled by hardware installation.

3.5 PROTECTION

- A. Provide for proper protection of items of hardware until Owner accepts Project as complete.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal channel ceiling framing.
- C. Acoustic insulation.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 90 05 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

- A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2013.1.
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2013.1.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2012.
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2013.
- G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2011.
- J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.
- K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007 (Reapproved 2013).
- L. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2010a.
- M. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.
- N. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets; 1999 (Reapproved 2010).
- O. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; 2008b.
- P. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2013.
- Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

- R. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- S. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.
- T. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.
- U. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2012.
- V. ICC (IBC) - International Building Code; 2012.
- W. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.
- B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.02 BOARD MATERIALS

- A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
- B. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 - 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 - 2. Regular Board Thickness: 5/8 inch.
 - 3. Edges: Tapered.
- C. Ceiling Board: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings, unless otherwise indicated.
 - 2. Thickness: 5/8 inch.
 - 3. Edges: Tapered.

2.03 ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Match thickness of stud framing
- B. Acoustic Sealant: As specified in Section 07 90 05.
- C. Finishing Accessories: ASTM C1047, rolled zinc, unless otherwise indicated.
 - 1. Types: As detailed or required for finished appearance.
 - 2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.
- D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Ready-mixed vinyl-based joint compound.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
 1. Orientation: Horizontal.
 2. Spacing: As indicated.
- F. Blocking: Install blocking for support of:
 1. Wall mounted cabinets.
 2. Toilet partitions.
 3. Toilet accessories.
 4. Wall mounted door hardware.
 5. Storage Shelving
 6. TV's/Brackets
 6. Any item which requires fastening to wall surface.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 1. Level 5: Walls at Show Room and Consultation Space.
 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
 5. Level 0: Temporary partitions and surfaces indicated to be finished in later stage of project.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 3. Taping, filling and sanding is not required at base layer of double layer applications.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet

in any direction.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- C. Section 23 37 13 - Diffusers, Registers, and Grilles: Air diffusion devices in ceiling.
- D. Section 26 51 00 - Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2007.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2011.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2008e1.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.
- E. Manufacturer's Installation Instructions: Indicate special procedures and seismic installation instructions.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 SEISMIC CRITERIA

- A. Provide and install suspension system in accordance with ASTM E 580 for Areas Subject to Severe Seismic Disturbance.

1.08 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels Type ACT-1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
 - 1. Size: 24 x 24 inches.
 - 2. Thickness: 3/4 inches.
 - 3. Composition: Wet felted.
 - 4. NRC Range: 60 to 70, determined as specified in ASTM E1264.
 - 5. Edge: Reveal edge.
 - 6. Surface Color: White.
 - 7. Product: Eclipse Clima Plus by USG.
 - 8. Suspension System: Exposed grid Type SS-1.

2.02 SUSPENSION SYSTEM(S)

- A. Suspension Systems - General: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, and perimeter moldings as required.
- B. Provide and install suspension system in accordance with ASTM E 580 for Areas Subject to Severe Seismic Disturbance.
- C. Exposed Steel Suspension System Type SS-1: Formed galvanized steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: Tee; 15/16 inch wide face.
 - 2. Construction: Double web.
 - 3. Finish: White painted.

2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Install suspension system in accordance with ASTM E 580 for Areas Subject to Severe Seismic Disturbance.
- C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- D. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.
- K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
 - 2. Double cut and field paint exposed reveal edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 SCHEDULE

- A. Refer to drawings.

END OF SECTION

**SECTION 09 65 00
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Installation accessories.

1.02 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- B. ASTM F1700 - Standard Specification for Solid Vinyl Tile; 2013a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- D. Concrete Testing Standard: Submit a copy of ASTM F710.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. High Performance Luxury Vinyl Tile.
 - 1. Manufacturer: Interface
 - b. See drawings for color selections
 - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 3. Plank Size: 9 inches x 39 inches
 - 4. Wear Layer Thickness: 22 mil
 - 5. Total Thickness: 3mm

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
 - 1. Height: 4 inch.
 - 2. Thickness: 0.125 inch thick.
 - 3. Finish: Satin.
 - 4. Color: Color as selected from manufacturer's standards.

2.03 STAIR COVERING

- A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 1-5/8 inch deep.
 - 1. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
 - 2. Nominal Thickness: 0.1875 inch.
 - 3. Nosing: Square.

4. Style: Contrasting color abrasive grit strips full width.
 5. Color: Solid.
- B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color:
1. Thickness: 0.080 inch.

2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Adhesives: Type recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
 1. Test in accordance with ASTM F710.
 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Luxury vinyl flooring shall be installed with adhesive. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.
- E. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.05 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, and other coatings.
- C. Materials for backpriming woodwork.
- D. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished.
- E. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically so indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Allow 21 for approval process, after receipt of complete samples by Architect.

- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Coatings: 1 gallon of each color; store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content:
 - 1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Flammability: Comply with applicable code for surface burning characteristics.
- E. Colors: As indicated on drawings
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
 - 1. One coat of latex primer.
 - 2. Semi-gloss: Two coats of latex enamel.
- B. Paint ME-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
 - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 - 2. Semi-gloss: Two coats of latex enamel.

2.04 PAINT SYSTEMS - INTERIOR

- A. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
 - 1. One coat of latex primer sealer.
 - 2. Semi-gloss: Two coats of latex enamel.
- B. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
 - 1. One coat of block filler.
 - 2. Semi-gloss: Two coats of latex enamel.
- C. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
 - 1. One coat of latex primer.
 - 2. Semi-gloss: Two coats of latex enamel.
- D. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
 - 1. Touch-up with latex primer.
 - 2. Semi-gloss: Two coats of latex enamel.
- E. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
 - 1. One coat of alkyd primer sealer.
 - 2. Satin: Two coats of latex enamel.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

- L. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- M. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's instructions.
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

3.06 SCHEDULE - PAINT SYSTEMS

- A. Gypsum Board: Finish all surfaces exposed to view.
 - 1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
 - 2. Interior Walls: GI-OP-3L, Satin.
 - 3. Interior Walls That are Painted Black: GI-OP-3L, flat level 5.
- B. Wood: Finish all surfaces exposed to view.
 - 1. Interior wood doors: WI-TR-VS, satin.
 - 2. Interior wood: WI-OP-3L.
- C. Steel Doors and Frames: Finish all surfaces exposed to view; MI-OP-3L, semi-gloss.
- D. CMU: Paint CI-OP-3L.

END OF SECTION

SECTION 10 51 00

POLYETHYLENE LOCKERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Solid plastic lockers
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Division 06: Rough carpentry.
- C. References
 - 1. UL – GREENGUARD certified low emitting materials.
 - 2. ASTM - B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. ASTM – A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

1.2 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Include dimensioned layouts, elevations, trim, closures and accessories.
 - 2. Product Data: Manufacturer's descriptive data
 - 3. Samples: 3 x 3 inch samples in each color.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years of experience in manufacture of solid plastic lockers with products in satisfactory use under similar service conditions.
- B. Installer Qualifications: Minimum 5 years of experience in work of this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store in an upright condition. Protect plastic lockers from exposure to direct sunlight. This product is not intended for outdoor use.

1.5 WARRANTY

- A. Provide manufacturer's 25 year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Scranton Products. (www.scrantonproducts.com)

B. Substitutions: See Section 01 60 00 – Product Requirements

C. Materials

1. High Density Polyethylene (HDPE): polyethylene thermoplastic formed into solid plastic components with homogeneous color throughout, with smooth orange peel finish.
2. Heavy Duty Extruded Aluminum: B221, 6063-T6
3. Chromium Plated Steel: A167
4. Recycled content: Minimum 25 percent.
5. Color: Select from manufacturer's standard colors.

2.2 PLASTIC LOCKERS

A. Locker Configuration: Two tier

B. Locker Dimensions:

1. Height, Nominal: 60 inch
2. Width: 12 inch
3. Depth: 18 inch

C. Material: High density polyethylene (HDPE) plastic.

D. Sides, Tops, Bottoms, Backs, and Shelves: 3/8 inch thick HDPE plastic.

1. Sides: 3/8 inch thick HDPE plastic.

E. Locker Tops: Flat top finished in same color as locker door.

F. Doors and Frame: 1/2 inch thick HDPE plastic

1. Doors: 1/2 inch thick HDPE plastic.
2. Handle: ADA compliant ergonomic handle, injection molded plastic
3. Locks: Padlock hasp
4. Hinge: Heavy duty extruded aluminum with corrosion free stainless steel pin with silver finish.
5. ADA Compliance Package: 3134 aluminum Series 1100, H18, satin matte finish ADA plaque, adjustable 3/8 inch HDPE plastic shelf with plastic clips
6. Latch Bar: 3/8 inch thick HDPE plastic with multiple latch points, fastened with stainless steel tamper-resistant screws

G. Assembly profile: Full height of lockers, PVC plastic, snap fit assembled onto locker sides.

H. Accessories

1. End Panels: 1 inch thick HDPE plastic, color and finish same as locker door
2. Filler Panels and Trim: 1/2 inch thick HDPE plastic, color and finish same as locker door
3. Number Plate: 3134 aluminum, Series 1100, H18, satin matte finish, fastened to locker with corrosion resistant stainless steel rivets.
4. Padlock hasp.
5. Louver venting.
6. Wall hook: two per door opening.
7. Color: As selected by Architect from manufacturer's color range.

2.3 FABRICATION

A. Fabricate locker components square and rigid; finish free from scratches and chips.

B. Fabricate locker components for snap-together assembly or slide-together dovetail connections providing solid and secure, anti-racking construction.

C. Fabricate adjacent lockers with common side panel.

- D. Fabricate locker units for assembly in maximum of three adjacent lockers.
- E. Fabricate locker benches to sizes indicated in single lengths.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install lockers in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Refer to Drawings for base details.
- C. Set plumb, level, rigid, and aligned.
- D. Attach lockers to supporting construction with anchors best suited to substrate conditions.
- E. Attach locker benches to floor.

3.2 ADJUSTING

- A. Adjust doors and latches to operate correctly.

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinetwork.
- B. Vanity tops.

1.02 RELATED REQUIREMENTS

- A. Section 06 41 00 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.
- C. ISSFA-2 - Classification and Standards for Solid Surfacing Material; International Solid Surface Fabricators Association; 2001 (2007).
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- E. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Installation Instructions: Manufacturer's installation instructions and recommendations.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

- A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/4 inch, minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
 - b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - c. Color and Pattern: As indicated on drawings.
 - 3. Other Components Thickness: 1/2 inch, minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; bullnosed edge; use marine edge at sinks.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
- B. Natural Stone Countertops: Stone slabs bonded to substrate; use as large pieces as possible with inconspicuous adhesive joints.
 - 1. Stone: Granite without cracks, voids, or pin holes; filling with matching epoxy resin is acceptable.
 - 2. Color: As specified.
 - 3. Stone Thickness: 1/2 inch, minimum.
 - 4. Surface Finish: Polished.
 - 5. Exposed Edge Treatment: Stone bullnose, 1 inch radius.
 - 6. Back and End Splashes: Same material, same thickness; for field attachment.

2.02 ACCESSORY MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

**SECTION 220000
BASIC PLUMBING MATERIALS AND METHODS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 22.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 IMPOSED REGULATIONS:

- A. Applicable provisions of the State and Local Codes and of the codes and standards listed on the contract documents in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for plumbing work.

1.3 SCOPE OF WORK:

- A. Provide all labor, materials, equipment and supervision to construct complete and operable plumbing systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.4 RELATED DOCUMENTS AND OTHER INFORMATION:

- A. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements and Division 01 Specification Sections, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

1.5 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Wall sleeve fittings.
 - 5. Grout.
 - 6. Escutcheons.
 - 7. Floor plates.

1.6 ACTION SUBMITTALS

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

1.7 QUALITY ASSURANCE SUBMITTALS

- A. Welding certificates.

1.8 **EXISTING SERVICES AND FACILITIES:**

- A. **Damage to Existing Services:** Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.
- B. **Interruption of Services:** Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Contractor shall provide no less than 14 days notice to owner when scheduling outages. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

1.9 **PRODUCT WARRANTIES:**

- A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceeds the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.10 **PRODUCT SUBSTITUTIONS:**

- A. **General:** Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Architect/Engineer at least 14 days prior to opening of bids. Refer to the general conditions for the substitution request form and required documentation.

1.11 **QUALITY ASSURANCE**

- A. **Products Criteria:**
 - 1. **Standard Products:** Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions.
 - 2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
 - 3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Architect/Engineer.
 - 4. **Multiple Units:** When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
 - 5. **Assembled Units:** Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 - 6. **Nameplates:** Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast

- integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
7. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
 2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
 3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
- C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be furnished to the Architect/Engineer prior to installation along with the respective product data submittals.
- D. Execution (Installation, Construction) Quality:
1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Architect/Engineer for resolution. Provide manufacturer's installation instructions along with the respective product data submittals to the Architect/Engineer at least two weeks prior to commencing installation of any item.
 2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract drawings to the Architect/Engineer for resolution.

1.12 SUBMITTALS

- A. Submit in accordance with Division 1 specifications.
- B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- D. Upon request by Owner, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.
- E. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 1. Submit electric motor data and variable speed drive data with the driven equipment.
 2. Equipment and materials identification.

3. Hangers, inserts, supports and bracing.
Provide load calculations for variable spring and constant support hangers.
4. Wall, floor, and ceiling plates.

F. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Division 1 specifications for systems and equipment.
2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.13 **DELIVERY, STORAGE AND HANDLING**

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Architect/Engineer. Such repair or replacement shall be at no additional cost to the Owner.
3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Owner.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

PART 2 - PRODUCTS.

2.1 **FACTORY-ASSEMBLED PRODUCTS**

A. Provide maximum standardization of components to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for intended service.
 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 **COMPATIBILITY OF RELATED EQUIPMENT**

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 **PIPE PENETRATIONS**

- A. Install sleeves during construction for all pipe penetrations.
- B. Penetrations are not allowed through beams or ribs. With prior approval of Structural Engineer, penetrations may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Architect/Engineer.
- C. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- D. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- E. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation.

2.4 **TOOLS**

- A. Furnish, and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

2.5 **SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.11 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL:

- A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.
- B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.
- C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect/Engineer five days in advance of any testing.

3.2 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment, access provisions, and work of all trades. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities.
- B. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- C. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.
- D. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- E. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- F. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by Architect/Engineer where working area space is limited.
 2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by Architect/Engineer. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to Architect/Engineer for approval.
 3. Do not penetrate membrane waterproofing.
- G. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- H. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- I. Protection and Cleaning:
1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Architect/Engineer. Damaged or defective items in the opinion of the Architect/Engineer shall be replaced.
 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
 3. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum.
- J. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- K. Electrical and Pneumatic Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.

3.3 **CLEANING AND PAINTING**

- A. Prior to final inspection and acceptance of the building for beneficial use by the Owner, the building facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to architectural specifications for additional painting requirements.
- B. In addition, the following special conditions apply:
1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
 2. Material And Equipment Not To Be Painted Includes:

- a. Motors, controllers, control switches, and safety switches.
 - b. Control and interlock devices.
 - c. Regulators.
 - d. Pressure reducing valves.
 - e. Control valves and thermostatic elements.
 - f. Lubrication devices and grease fittings.
 - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - h. Valve stems and rotating shafts.
 - i. Pressure gauges and thermometers.
 - j. Glass.
 - k. Name plates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
 4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
 6. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.4 **STARTUP AND TEMPORARY OPERATION**

- A. Startup equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

3.5 **OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, perform required tests as required in the other Division 22 specification sections, and submit the test reports and records to the Architect/Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner. Notify Architect/Engineer.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.6 **SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Cut sleeves to length for mounting flush with both surfaces.

- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.7 **STACK-SLEEVE-FITTING INSTALLATION**

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Coordinate flashing with Architect/general contractor.
 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring.
 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.8 **SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.9 **WALL SLEEVE FITTING INSTALLATION**

- A. Install wall sleeve fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.

- D. Using grout, seal the space around outside of wall sleeve fittings.

3.10 **ESCUTCHEON INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
 - 2. Existing Piping: Split-casting, floor-plate type.

3.11 **FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220000

SECTION 22 05 10

PLUMBING COORDINATION

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

A. Plumbing Coordination Drawings

1. Prepare a set of coordination drawings showing the coordination of the major elements, components, and systems of the Plumbing work, and showing the coordination of Plumbing work with other work. Prepare drawings at accurate scale and sufficiently large to show locations of every item, including clearances for installing, maintaining, insulating, breaking down equipment, replacing motors and similar requirements. Drawings shall indicate coordination with all other trades including, but not limited to, lighting, structural, plumbing, mechanical and architectural items. Prepare drawings to include plans, elevations, sections and details as needed to conclusively show successful coordination and integration of the work. Submit drawings for review by the Architect/Engineer and Owner.
 - i. Plans shall include dimensioned locations of all Floor Drains.
 - ii. Plans shall include locations of all ceiling and wall access panels required for equipment access (valves, for example).

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings

1. During construction operations, the Plumbing contractor shall faithfully make a record of all approved changes from the contract drawings, including accurate dimensions where applicable, and shall also record accurate dimensions locating all below-grade and under-slab Plumbing utilities (whether changed or not) with reference to permanent above-grade objects. A minimum of two (2) dimensions from building reference points shall be provided and a bury depth indicated. At completion of the work, all such changes shall be recorded neatly with red ink by the Plumbing contractor on an unused set of the Plumbing contract drawings.

1.3 RELATED DOCUMENTS AND OTHER INFORMATION:

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

PART 2 - PRODUCTS

1.1 PLUMBING PRODUCT COORDINATION:

- A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power driven item of Plumbing equipment. The electrical design was based on the power requirements of the Plumbing equipment manufacturer scheduled or specified as "basis of design." Any modifications to the electrical system that are required due to the use of an approved

- equivalent manufacturer shall be made at no additional cost to the Owner. All changes must be clearly documented and submitted for review by the Architect/Engineer prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. Refer to Division 26 specifications for additional coordination requirements.
- B. Coordination of Options and Substitutions: When the contract documents permit the selection from several product options and it becomes necessary to authorize a substitution, do not proceed with purchase until coordination of interface to equipment has been checked and satisfactorily established.
 - C. Prior to submitting shop drawings for approval, contractor shall certify that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

PART 3 - EXECUTION

1.1 INSPECTION AND PREPARATION:

- A. Substrate Examination: The Installer of each element of the Plumbing work must examine the condition of the substrate to receive the work, the conditions under which the work will be performed, and must notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Do not proceed with the installation of sleeves, anchors, hangers, roof penetrations and similar work until Plumbing coordination drawings have been processed and released for construction.
- C. Where work must be installed prior to that time in order to avoid a project delay, review proposed installation in a project coordination meeting including all parties involved with the interfacing of the work.

1.2 CUTTING AND PATCHING:

- A. Structural Limitations: Do not cut structural framing, walls, floors, decks and other members intended to withstand stress, except with the Architect's or Engineer's written authorization. Authorization will be granted only where there is no other reasonable method for completing the Plumbing work, and where the proposed cutting clearly does not materially weaken the structure.
- B. Where authorized, cut opening through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.
- C. Other work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate Plumbing work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.
- D. in the recommended manner.
- E. Where patching is required to restore other work, because of either cutting or other damage

inflicted during the installation of Plumbing work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Architect. Engage the original Installer to complete patching of the following categories of work:

1. Exposed concrete finishes.
2. Exposed masonry.
3. Waterproofing and vapor barriers.
4. Roofing, flashing and accessories.
5. Interior exposed finishes and casework, where judged by the Architect to be difficult to achieve an acceptable match by other means.

1.3 COORDINATION OF PLUMBING INSTALLATION:

- A. General: Sequence, coordinate and integrate the various elements of Plumbing work so that the Plumbing system will perform as indicated and be in harmony with the other work of the building. The Architect/Engineer will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:
1. Install piping and similar services straight and true, aligned with other work and with overhead structures and allowing for insulation. Conceal where possible.
 - 2.
 3. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
 4. Give the right-of way to piping systems required to slope for drainage (over other service lines). Piping shall be located to avoid interference with ductwork and light fixtures.
- B. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Architect/Engineer's decision on resolution of the conflict.
- C. Electrical Work: Coordinate the Plumbing work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install Plumbing equipment ready for electrical connection. Refer to the electrical sections of the specifications for electrical connection of Plumbing equipment.
- D. Utility Connections: Coordinate the connection of Plumbing systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies.
- E. sed service companies and controlling agencies.
1. Provide a single connection for each service except where multiple connections are indicated. Water, tap, meter, and vault cost shall be incurred by the Contractor.

END OF SECTION 220510

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Bronze swing check valves.
- B. Related Sections:
 - 1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF/ANSI Compliance: NSF 61 for valve materials for potable-water service.
- D. NSF/ANSI Compliance: NSF 372 for low lead construction 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 gate and globe valves closed to prevent rattling.
 - 4. Set ball valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- 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 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Standards: NSF/ANSI 61 & 372.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.

2. Handlever: For quarter-turn valves NPS 6 and smaller.
- F. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- G. Valve-End Connections:
 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Solder Joint: With sockets according to ASME B16.18.
 3. Threaded: With threads according to ASME B1.20.1.
- H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
 - d. Hammond Valve.
 - e. Jamesbury; a subsidiary of Metso Automation.
 - f. Kitz Corporation.
 - g. Marwin Valve; a division of Richards Industries.
 - h. Milwaukee Valve Company.
 - i. RuB Inc.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Apollo Valves.
 - b. Crane Valves.
 - c. Hammond Valve.
 - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 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.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. 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 classes or CWP ratings may be substituted.

- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: One piece, full port, brass or bronze with brass trim.
 - 3. Bronze Swing Check Valves: Class 125, nonmetallic disc.

END OF SECTION 220523

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

- B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE 7.
 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 1. Trapeze pipe hangers.
 2. Metal framing systems.
 3. Pipe stands.
 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 1. Detail fabrication and assembly of trapeze hangers.
 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Copper Pipe Hangers:
 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.
 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 3. Standard: MFMA-4.
 4. Channels: Continuous slotted steel channel with inturred lips.
 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
 7. Metallic Coating Hot-dipped galvanized.
 8. Paint Coating: Epoxy.
 9. Plastic Coating: Epoxy.
- B. Non-MFMA Manufacturer Metal Framing Systems:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Anvil International; a subsidiary of Mueller Water Products Inc.
 - b. Empire Industries, Inc.
 - c. ERICO International Corporation.
 - d. Haydon Corporation; H-Strut Division.
 - e. NIBCO INC.
 - f. PHD Manufacturing, Inc.
 - g. PHS Industries, Inc.
 2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 3. Standard: Comply with MFMA-4.
 4. Channels: Continuous slotted steel channel with inturred lips.
 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
 7. Coating: PVC.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Carpenter & Paterson, Inc.
 - 2. Clement Support Services.
 - 3. ERICO International Corporation.
 - 4. National Pipe Hanger Corporation.
 - 5. PHS Industries, Inc.
 - 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 7. Piping Technology & Products, Inc.
 - 8. Rilco Manufacturing Co., Inc.
 - 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- O. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

Option: Thermal-hanger shield inserts may be used. High-compressive-strength inserts may permit use of shorter shields or shields with less arc span. Revise first subparagraph below to suit Project.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service indoor applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for outdoor or hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 - 10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 13. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if long ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit signed and sealed shop drawings from a professional engineer. Shop drawings to include project specific details, sketches, product data cut sheets.
- B. See drawings for additional requirements.

PART 2 - NOT USED.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Refer to the details and notes on the construction documents.

3.2 FIELD QUALITY CONTROL

- A. Inspect installation after installation and submit report.

END OF SECTION 220548

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Valve tags.
 - 5. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black .
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Domestic Cold, Hot, and Return Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 2. Sanitary Waste and Vent Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape: 1-1/2 inches round
 - 2. Valve-Tag Color: Natural
 - 3. Letter Color: Black

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
- B. Related Sections:
 - 1. Section 220716 "Plumbing Equipment Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 4. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 5. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: 60 percent by volume and 66 percent by weight.
 - 5. Color: White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.

2.7 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.

3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C & F Wire.

2.8 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers, :
 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. Engineered Brass Company.
 - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing.
 - d. Plumberex.
 - e. Truebro; a brand of IPS Corporation.
 - f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures, :
 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. Truebro; a brand of IPS Corporation.
 - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt

- each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded

fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground domestic cold and waste piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1 and Smaller: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

END OF SECTION 220719

SECTION 221116
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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect/Engineer/Owner no fewer than five days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect/Engineer/Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 61.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- G. Copper or Bronze Pressure-Seal Fittings:
 - 1. Housing: Copper.
 - 2. O-Rings and Pipe Stops: EPDM.
 - 3. Tools: Manufacturer's special tools.
 - 4. Minimum 200-psig working-pressure rating at 250 deg F.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Tube.

2.5 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc.; a Sensus company.
 - g. Viking Johnson.
 - h. Or approved equal.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International.
 - e. Matco-Norca.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
 - i. Or approved equal.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 250 psig minimum at 180 deg F.

4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Watts; a division of Watts Water Technologies, Inc.
 - e. Wilkins; a Zurn company.
 - f. Or approved equal.
2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 175 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install domestic water piping level and plumb. Provide drain with hose fitting at all low points where possible.

- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. 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.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
- H. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.

- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

- A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- B. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using, including domestic cold water, hot water, and hot water return (if present) systems. Perform cleaning and disinfection after all pipes, valves, fixtures, and other components of the systems are installed, tested, and ready for operation.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

- a. Thoroughly flush piping with clean, potable water prior to disinfection to remove dirt and other contaminants. Remove faucet and strainer screens before flushing and reinstall after disinfection is completed.
- b. Disinfection shall be done using chlorine, either gas or liquid. Calcium or sodium hypochlorite or another approved disinfectant may be used. Use nonhazardous materials that can be drained to the city sewer.
- c. A service cock shall be provided and located at the water service entrance. The disinfecting agent shall be injected into and through the system from this cock only.
- d. The disinfecting agent shall be injected by a proportioning pump or device through the service cock slowly and continuously at an even rate. During disinfection, flow of the disinfecting agent into the main connected to the public water supply is not permitted.
- e. All sectional valves shall be opened during disinfection. All outlets shall be fully opened at least twice during injection and the residual checked with orthotolidine solution.
- f. If chlorine is used, when the chlorine residual concentration, calculated on the volume of water the piping will contain, indicates not less than 50 parts per million (ppm) or milligrams per liter at all outlets, then all valves shall be closed and secured. Make sure the pipe material is compatible with chlorine.
- g. The residual chlorine shall be retained in the piping systems for a period of at least 24 hours.
- h. After the retention, the residual chlorine shall be at least 5 ppm. If it is less than 5 ppm, then the process shall be repeated as described above.
- i. If the residual level is satisfactory, then all fixtures shall be flushed with clean, potable water until residual chlorine by the orthotolidine test is not greater than that of the incoming water supply.
- j. All work and certification of performance shall be performed by approved applicators or qualified personnel with chemical and laboratory experience. Certification of performance shall indicate the job name and location and the date when disinfection was performed, material used for disinfection, retention period of the disinfectant in the piping system, ppm (mg/L) of chlorine during retention, ppm (mg/L) of chlorine after flushing, a statement that disinfection was performed as specified, and the signature and address of the person performing the disinfection.
- k. Upon completion of final flushing (after the retention period), the contractor shall obtain at least one water sample from each hot, hot return (if present), and cold water line and submit the samples to an approved laboratory. Samples shall be taken from faucets located at the highest floor and furthest from the meter or main water supply. The laboratory report shall show the name and address of the approved laboratory testing the sample, name and location of the job, date the samples were obtained, coliform organism count, and any other tests required by local code authorities. An acceptable test shall show the absence of coliform organisms.
- l. If the analysis does not satisfy the minimum requirements, the disinfection procedure shall be repeated until acceptable.
- m. Before acceptance of the systems, the contractor shall submit for review three copies of the laboratory report and three copies of the certification of performance as specified.
- n. Under no circumstances shall the contractor permit the use of any portion of the domestic water system until it is properly disinfected, flushed, and certified.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Aboveground domestic water piping shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller.
 - 2. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 - 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing valves.
 - 2. Temperature-actuated, water mixing valves.
 - 3. Strainers.
 - 4. Water-hammer arresters.
 - 5. Flexible connectors.
- B. Related Requirements:
 - 1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Section 221116 "Domestic Water Piping" for water meters.
 - 3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
 - 4. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
 - 5. Section 224713 "Drinking Fountains" for water filters for water coolers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Corporation; Bell & Gossett Div.
 - d. NIBCO Inc.
 - e. TAC.
 - f. TACO Incorporated.
 - g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - 2. Type: Ball valve with two readout ports and memory-setting indicator.
 - 3. Body: Brass or bronze.
 - 4. Size: Same as connected piping, but not larger than NPS 2.
 - 5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering Valves:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Cash Acme; a division of Reliance Worldwide Corporation.
 - b. Conbraco Industries, Inc.
 - c. Honeywell International Inc.
 - d. Lawler Manufacturing Company, Inc.
 - e. Leonard Valve Company.
 - f. Powers; a division of Watts Water Technologies, Inc.
 - g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
 - 2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
 - 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
 - 4. Body: Bronze body with corrosion-resistant interior components.
 - 5. Temperature Control: Adjustable.
 - 6. Inlets and Outlet: Threaded.

7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 120 degF .
9. Tempered-Water Design Flow Rate: 0.5 gpm.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron[with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and] for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

2.6 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Precision Plumbing Products, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products.
 - i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.7 FLEXIBLE CONNECTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pession, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- B. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each control valve.
- F. Install water-hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Calibrated balancing valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 221316

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE 7-10.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For coordination. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect/ Construction Manager/ Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Architect's/Construction Manager's/Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Charlotte Pipe & Foundry.
 - c. MIFAB, Inc.
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. Tyler Pipe.
 - f. Ideal
 - g. Or approved equal.
 - 2. Standards: ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.
 - 2) Central Plastics Company.
 - 3) Hart Industries International, Inc.
 - 4) Jomar International Ltd.
 - 5) Matco-Norca, Inc.
 - 6) McDonald, A. Y. Mfg. Co.
 - 7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 8) Wilkins; a Zurn company.
 - 9) Or approved equal.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 125 psig minimum at 180 deg F.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.
 - 2) Central Plastics Company.
 - 3) Matco-Norca, Inc.
 - 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 5) Wilkins; a Zurn company.
 - 6) Or approved equal.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Factory-fabricated, bolted, companion-flange assembly.
 - 3) Pressure Rating: 125 psig minimum at 180 deg F.
 - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Advance Products & Systems, Inc.
 - 2) Calpico, Inc.

- 3) Central Plastics Company.
- 4) Pipeline Seal and Insulator, Inc.
- 5) Or approved equal.

b. Description:

- 1) Nonconducting materials for field assembly of companion flanges.
- 2) Pressure Rating: 150 psig .
- 3) Gasket: Neoprene or phenolic.
- 4) Bolt Sleeves: Phenolic or polyethylene.
- 5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Elster Perfection.
- 2) Grinnell Mechanical Products.
- 3) Matco-Norca, Inc.
- 4) Precision Plumbing Products, Inc.
- 5) Victaulic Company.
- 6) Or approved equal.

b. Description:

- 1) Standard: IAPMO PS 66
- 2) Electroplated steel nipple.
- 3) Pressure Rating: 300 psig at 225 deg F .
- 4) End Connections: Male threaded or grooved.
- 5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section "Earth Moving."

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 coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. 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 two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow 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.
- L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Sanitary Drainage Piping: 1/4" per foot downward in direction of flow for piping NPS 2 and smaller; 1/8" per foot downward in direction of flow for piping NPS 3 and larger.
 - 2. Vent Piping: 1/8" per 1' down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- O. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- P. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with caulked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. 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.
- E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping Shielded, nonpressure transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
 - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves:
 1. Install shutoff valve on each sewage pump discharge.
 2. Install gate or full-port ball valve for piping NPS 2 and smaller.
 3. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. 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: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. 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. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. 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.
 - 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.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 6. 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 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 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. 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. 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.

3.10 CLEANING AND PROTECTION

- 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.

3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 3. Copper DWV tube, copper drainage fittings, and soldered joints.
- D. Underground, soil, waste, and vent piping shall be the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 221316

SECTION 224000
PLUMBING FIXTURES

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 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes in accordance with Section 013300.
- B. Manufacturer's Instructions: Indicate installation methods and procedures.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

- A. ANSI Standards: Comply with ANSI Standards pertaining to plumbing fixtures and systems.
- B. ANSI Standards: Comply with ANSI A117.1 standard pertaining to plumbing fixtures for handicapped.
- C. PDI Compliance: Comply with standards established by Plumbing and Drainage institute (PDI) pertaining to plumbing fixture supports.
- D. Federal Standards: Comply with applicable Federal Standard FS WW-P-541/Series sections pertaining to plumbing fixtures.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. General: Provide factory-fabricated fixtures of the type, style and material indicated in contract documents. For each type of fixture, unless otherwise specified, provide fixture manufacturer's standard trim, carrier seats and valves as indicated by their published product information, either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation.

2.2 MATERIALS

- A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541/series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541/specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541.
- B. Provide materials that have been selected for their surface flatness and smoothness. Exposed surface which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration or other surface imperfections on finished units are not acceptable.
- C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units.
- D. Unless noted otherwise, provide solid heavy chrome plated cast brass (17 gauge) P-Trap with 2" minimum water seal and cast brass slip nut. Exposed P-Traps shall be fitted with cleanout plug.
- E. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and speck; glaze

exposed surfaces and test for crazing resistance in accordance with ASTM C 554. Vitreous China and Enamel Iron Fixtures shall be white.

- F. Lavatory stop valves shall be polished chrome-plated heavy cast construction and shall be installed with chrome-plated brass threaded nipple.

1. Manufacturers: McGuire, EBC, or approved equal.

G. Provide copper stub outs with support from a pipe alignment bracket or wall flange attached to wall blocking.

G-H. Comply with additional fixture requirements contained in the fixture schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install plumbing fixtures of types indicated where shown and at indicated heights or where not shown in accordance with manufacturer's written instruction, roughing-in drawings and with recognized industry practices.
- B. Fasten plumbing fixtures securely to indicated supports or building structure, and ensure that fixtures are level and plumb and tight against mounting surface.
- C. Seal the outer perimeter of wall mounted lavatories and urinals and water closets to the wall and floor mounted water closets to the floor with a smooth bead of white silicone compound.

3.2 FIELD QUALITY CONTROL

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test and adjust fixtures for proper operation.

END OF SECTION 224000

**SECTION 23 00 00
BASIC MECHANICAL MATERIALS AND METHODS**

PART 1 - GENERAL

1.01 IMPOSED REGULATIONS:

- A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for mechanical work: codes and standards listed on the mechanical drawings.

1.02 SCOPE OF WORK:

- A. Provide all labor, materials, equipment and supervision to construct complete and operable mechanical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.03 RELATED DOCUMENTS AND OTHER INFORMATION:

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.
- B. It is recognized that separate sub-contracts may be instituted by THIS CONTRACT'S GENERAL CONTRACTOR with others. It is the responsibility of THIS CONTRACT'S GENERAL CONTRACTOR to completely inform, coordinate and advise those sub-contractors as to all of the requirements, conditions and information associated with providing and installing their portion of the total job.

1.04 PRODUCT WARRANTIES:

- A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceeds the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.05 PRODUCT SUBSTITUTIONS:

- A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Architect at least 10 days prior to opening of bids. Refer to the general conditions for the substitution request form and required documentation.

PART 2 - PRODUCTS

2.01 GENERAL MECHANICAL PRODUCT REQUIREMENTS

- A. Standard Products: Provide not less (quality) than manufacturer's standard products, as specified by their published product data. In addition to the indication that a particular product/model number is acceptable, comply with the specified requirements. Do not assume that the available off-the-shelf condition of a product complies with the requirements; as an example, a specific finish or color may be required.
- B. Uniformity: Where multiple units of a general product are required for the mechanical work, provide identical products by the same manufacturer, without variations except for sizes and similar variations as indicated.
- C. Product Compatibility, Options: Where more than one product selection is specified, either generically or proprietarily, selection is Purchaser's or Installer's option. Provide mechanical adaptations as needed for interfacing of selected products in the work.

- D. Equipment Nameplates: Provide a permanent operational data nameplate on each item of power operated mechanical equipment, indicating the manufacturer, product name, model number, serial number, speed, capacity, power characteristics, labels of tested compliance, and similar essential operating data.
- E. Locate nameplates in easy-to-read locations. When product is visually exposed in an occupied area of the building, locate nameplate in a concealed position (where possible) which is accessible for reading by service personnel.

PART 3 - EXECUTION

3.01 PRODUCT INSTALLATION, GENERAL:

- A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.
- B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.
- C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect five days in advance of any testing.
- D. Where components such as duct, pipe, conduit, etc. pass through non-fire-rated, interior partitions, fill void between component and opening in wall with fiberglass insulation and sealant for acoustical separation.

END OF SECTION

**SECTION 23 05 10
MECHANICAL COORDINATION**

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

- A. Mechanical Coordination Drawings: Prepare a set of coordination drawings showing the coordination of the major elements, components and systems of the mechanical work, and showing the coordination of mechanical work with other work. Prepare drawings at accurate scale and sufficiently large to show locations of every item, including clearances for installing, maintaining, insulating, breaking down equipment, replacing motors and similar requirements. Drawings shall indicate coordination with all other trades including, but not limited to, lighting, structural, plumbing and architectural items. Where applicable, existing conditions shall be accounted for. Prepare drawings to include plans, elevations, sections and details as needed to conclusively show successful coordination and integration of the work. Submit drawings for review by the Architect/Engineer.

PART 2 - PRODUCTS

2.01 MECHANICAL PRODUCT COORDINATION

- A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power driven item of mechanical equipment. The electrical design was based on the power requirements of the mechanical equipment manufacturer scheduled or specified as "basis of design." Any modifications to the electrical system that are required due to the use of an approved equivalent manufacturer shall be made at no additional cost to the owner. All changes must be clearly documented and submitted for review by the Architect/Engineer prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. Refer to specification Div. 26 for additional coordination requirements.
- B. Coordination of Options and Substitutions: When the contract documents permit the selection from several product options and it becomes necessary to authorize a substitution, do not proceed with purchase until coordination of interface to equipment has been checked and satisfactorily established.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Substrate Examination: The Installer of each element of the mechanical work must examine the condition of the substrate to receive the work, the conditions under which the work will be performed, and must notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Do not proceed with the installation of sleeves, anchors, hangers, roof penetrations and similar work until mechanical coordination drawings have been processed and released for construction. Where work must be installed prior to that time in order to avoid a project delay, review proposed installation in a project coordination meeting including all parties involved with the interfacing of the work.

3.02 CUTTING AND PATCHING

- A. Structural Limitations: Do not cut structural framing, walls, floors, decks and other members intended to withstand stress, except with the Architect's or Engineer's written authorization. Authorization will be granted only where there is not other reasonable method for completing the mechanical work, and where the proposed cutting clearly does not materially weaken the structure.
- B. Where authorized, cut opening through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

- C. Other work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.
- D. Where patching is required to restore other work, because of either cutting or other damage inflicted during the installation of mechanical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Architect. Engage the original Installer to complete patching of the following categories of work:
 - 1. Exposed concrete finishes.
 - 2. Exposed masonry.
 - 3. Waterproofing and vapor barriers.
 - 4. Roofing, flashing and accessories.
 - 5. Interior exposed finishes and casework, where judged by the Architect to be difficult to achieve an acceptable match by other means.

3.03 COORDINATION OF MECHANICAL INSTALLATION

- A. General: Sequence, coordinate and integrate the various elements of mechanical work so that the mechanical plant will perform as indicated and be in harmony with the other work of the building. The Architect/Engineer will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:
- B. Install piping, ductwork and similar services straight and true, aligned with other work and with overhead structures and allowing for insulation. Conceal where possible.
- C. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
- D. Give the right-of way to piping systems required to slope for drainage (over other service lines).
- E. Piping shall be located to avoid interference with ductwork and light fixtures.
- F. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of the conflict.
- G. Electrical Work: Coordinate the mechanical work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install mechanical equipment ready for electrical connection. Refer to the electrical sections of the specifications for electrical connection of mechanical equipment.
- H. Utility Connections: Coordinate the connection of mechanical systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Provide a single connection for each service except where multiple connections are indicated.

3.04 COORDINATION OF MECHANICAL START-UP

- A. Seasonal Requirements: Adjust and coordinate the timing of mechanical system start-ups with seasonal variations, so that demonstration and testing of specified performance can be observed and recorded. Exercise proper care in off-season start-ups to ensure that systems and equipment will not be damaged by the operation.
- B. Painting and Air Distribution: Coordinate the initial cleaning and start-up of the HVAC air distribution system, to occur prior to preparatory cleaning and general interior painting and decorating on the project.

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. See "Multispeed and Variable-Speed Considerations" Article in the Evaluations for discussion of motor controllers. Retain first paragraph below only if Project includes separately connected motors and where controllers are not furnished as a component of the motorized equipment.

- B. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- C. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- D. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Equipment supports.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
 - 3. Section 233113 "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Pipe stands.
 - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.06 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.07 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel .
- B. Stainless-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 2. Standard: MFMA-4.
 - 3. Channels: Continuous slotted steel channel with inturned lips.
 - 4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - 6. Metallic Coating: Hot-dipped galvanized, Mill galvanized, or In-line, hot galvanized.
- B. Non-MFMA Manufacturer Metal Framing Systems:
 - 1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - 2. Standard: Comply with MFMA-4.
 - 3. Channels: Continuous slotted steel channel with inturned lips.
 - 4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - 6. Coating: Zinc, Paint, or PVC.

2.04 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece base unit with plastic roller, for roof installation without membrane penetration.
- D. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.07 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.08 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

- A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 3. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 5. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 6. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 7. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 8. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 9. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 10. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Elastomeric hangers.
 - 11. Spring hangers.
 - 12. Snubbers.
 - 13. Restraint channel bracings.
 - 14. Restraint cables.
 - 15. Seismic-restraint accessories.
 - 16. Mechanical anchor bolts.
 - 17. Adhesive anchor bolts.
 - 18. Vibration isolation equipment bases.
- B. Related Requirements:
 - 1. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.03 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
 - 1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction.
 - 2. Annotate to indicate application of each product submitted and compliance with requirements.
 - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

- C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic and wind forces required to select vibration isolators and seismic and wind restraints and for designing vibration isolation bases.
 1. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
 4. Seismic- and Wind-Restraint Details:
 1. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 2. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 3. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 4. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- C. Qualification Data: For professional engineer and testing agency.
- D. Welding certificates.
- E. Field quality-control reports.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent

testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

- E. ear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

1.01 MANUFACTURERS

- A. Unless specifically noted otherwise below, 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. Ace Mountings Co., Inc.
2. California Dynamics Corporation.
3. Isolation Technology, Inc.
4. Kinetics Noise Control, Inc.
5. Mason Industries, Inc.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation.
8. Vibration Mountings & Controls, Inc.
9. Or Pre-Approved Equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:

1. Basic Wind Speed: Refer to Architectural and/or Structural.
2. Building Classification Category: Refer to Architectural
3. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

- B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: See Structural
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: See Structural.
 1. Component Importance Factor: See Drawings.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): See Structural.
4. Design Spectral Response Acceleration at 1.0-Second Period: See Structural.
5. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.03 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads.

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties.
4. Surface Pattern: Smooth, Ribbed, or Waffle pattern.
5. Infused nonwoven cotton or synthetic fibers.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric .
 1. Surface Pattern: Smooth, Ribbed, or Waffle pattern.
 2. Infused nonwoven cotton or synthetic fibers.

2.04 ELASTOMERIC ISOLATION MOUNTS

- A. Double-Deflection, Elastomeric Isolation Mounts.

1. Mounting Plates:

1. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
2. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.05 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

- A. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
1. Housing: Cast-ductile iron or welded steel.
 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.06 OPEN-SPRING ISOLATORS

- A. Freestanding, Laterally Stable, Open-Spring Isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.07 HOUSED-SPRING ISOLATORS

- A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 1. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 2. Top housing with attachment and leveling bolt, threaded mounting holes and internal leveling device, or elastomeric pad.

2.08 RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint: .
1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
 1. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 2. Top plate with elastomeric pad.
 3. Internal leveling bolt that acts as blocking during installation.
 2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.09 HOUSED-RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: .

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
 1. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 2. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure

2.10 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.11 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.12 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods.

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.13 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.14 SNUBBERS

- A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.15 RESTRAINT CHANNEL BRACINGS

- 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. Cooper B-Line, Inc.
 2. Hilti, Inc.
 3. Mason Industries, Inc.
 4. Unistrut.
 5. Or Pre-Approved Equal.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.16 RESTRAINT CABLES

- 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. Kinetics Noise Control, Inc.
 2. Loos & Co., Inc.
 3. Vibration Mountings & Controls, Inc.
 4. Or Pre-Approved Equal.
- B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.17 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
 4. TOLCO.
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.18 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hilti, Inc.
 - 3. Kinetics Noise Control, Inc.
 - 4. Mason Industries, Inc.
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.19 ADHESIVE ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hilti, Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Or Pre-Approved Equal.
- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.20 VIBRATION ISOLATION EQUIPMENT BASES

- A. Steel Rails: Factory-fabricated, welded, structural-steel rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- B. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 4. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 5. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- C. Concrete Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.03 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete.", Section 033053 "Miscellaneous Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
 1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.06 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.07 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and

formwork specified in Section 033000 "Cast-in-Place Concrete.", Section 033053,
"Miscellaneous Cast-in-Place Concrete."

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Duct labels.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.04 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick and having predrilled holes for attachment hardware.
 - 2. Letter Color: White
 - 3. Background Color: Black
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.03 DUCT LABELS

- A. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, equipment name (i.e. AHU-1, etc.), and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.04 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue : For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Green : For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.03 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.04 ACTION SUBMITTALS

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.06 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB, or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB, or TABB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB, or TABB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect or Engineer.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.07 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.

5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation".
- C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

- d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.08 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 3. Check the refrigerant charge.
 4. Check the condition of filters.
 5. Check the condition of coils.
 6. Check the operation of the drain pan and condensate-drain trap.
 7. Check bearings and other lubricated parts for proper lubrication.
 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 4. Balance each air outlet.

3.08 TOLERANCES

- A. Set HVAC system's air flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.

3.09 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for fans performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Settings for supply-air, static-pressure controller.
 - g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Balancing stations.
 4. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with refrigerant coils, include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.

- k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Outdoor airflow in cfm.
 - i. Return airflow in cfm.
 - j. Outdoor-air damper position.
 - k. Return-air damper position.
 - l. Vortex damper position.
 - m. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - n. Return-air, wet- and dry-bulb temperatures in deg F.
 - o. Entering-air, wet- and dry-bulb temperatures in deg F.
 - p. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - q. Refrigerant expansion valve and refrigerant types.
 - r. Refrigerant suction pressure in psig.
 - s. Refrigerant suction temperature in deg F.
 - t. Average face velocity in fpm.
- F. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 2. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.

- h. Low-fire fuel input in Btu/h.
 - i. High-fire fuel input in Btu/h.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btu/h.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h.
- G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
- 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btu/h.
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Air flow rate in cfm.
 - i. Face area in sq. ft..
 - j. Minimum face velocity in fpm.
 - 2. Test Data (Indicated and Actual Values):
 - a. Heat output in Btu/h.
 - b. Air flow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- J. Instrument Calibration Reports:
 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.
- K. Space Differential Pressure Reports:
 1. Report Data
 - a. Provide differential pressures in all rooms indicated to have a positive or negative pressure relationship. Pressure relationship shall be ± 0.1 in. wg..

3.11 INSPECTIONS

- A. Initial Inspection:
 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - c. Verify that balancing devices are marked with final balance position.
 - d. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:
 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect or Engineer.
 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect or Engineer.
 3. Architect or Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

**SECTION 23 07 13
DUCT INSULATION**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply, return, and outdoor air.
 - 2. Indoor, exposed supply, return, and outdoor air.
 - 3. Duct Liner
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."
 - 2. Section 233113 "Metal Ducts".

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.08 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.
 - d. Or Approved Equal
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
 - f. Or Equal.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.
 - g. Or Equal.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.K-Flex USA; R-373 Contact Adhesive.
 - d. Or Equal.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.
 - c. Or Equal.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.
 - d. Or Equal.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - c. Or Equal.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 - d. Or Approved Equal.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

2.04 Color: White.

2.05 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - b. Vimasco Corporation; 713 and 714.
 - c. Or Equal.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.06 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - c. Mon-Eco Industries, Inc.; 44-05.
 - d. Or Equal.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.07 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - d. Or Equal.
 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.

2.09 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 - e. Or Equal.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 - c. Or Equal.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
 - 5) Or Equal.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CHP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
 - 5) Or Equal.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - 4) Or Equal.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - 3) Or Equal.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.

- 2) GEMCO; Peel & Press.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - 4) Or Equal.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - 5) Or Equal.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
 - 3) Or Equal.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, galvanized steel.
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. C & F Wire.
 - b. Or Equal.

2.11 DUCT LINER

- A. Fibrous duct liner in the airstream shall not be acceptable.
- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 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. Aeroflex USA Inc.
 - b. Armacell LLC.
 - c. Rubatex International, LLC
 - d. Or Equal
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08 FINISHES

- A. Insulation with Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. All supply, return, and outdoor air.
 - 2. Exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.
 - 8. Environmental air exhaust where energy recovery wheel is not present
 - 9. Where energy recovery wheel is present, environmental air exhaust after the wheel.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed supply, return, and outdoor-air duct and plenum insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2.2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Exposed supply, return, and outdoor-air duct in Utility and Service Spaces Below 8' Above Finished Floor, insulation shall be the following:
 - 1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- C. Exposed supply, return, and outdoor-air duct where indicated on the drawings or Metal Duct Specification to have single wall duct, insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2.2 inches thick and 0.75-lb/cu. ft. nominal density. Surface of insulation shall be prepared for painting to match adjacent surfaces, coordinate with architectural plans.
- D. Exposed supply, return, and outdoor-air duct where indicated on the drawings or Metal Duct Specifications to have double wall duct, liner shall be the following:
 - 1. If perforated inner duct is used: Flexible Elastomeric: 1 inch thick.
 - 2. If solid wall inner duct is used: Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft nominal density.

3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Supply, return, and outdoor air duct:
 - 1. Flexible Elastomeric: 2 inches thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed:
 - 1. Aluminum: 0.040 inch thick.

3.14 DUCT LINER

- A. Duct Liner:
 - 1. Return Air and Transfer Air Ducts: Flexible elastomeric, 1 inch thick.

END OF SECTION

**SECTION 23 31 13
METAL DUCTS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Double-wall round ducts and fittings.

 - 4. Sheet metal materials.
 - 5. Sealants and gaskets.
 - 6. Hangers and supports.
 - 7. Seismic-restraint devices.
- B. Related Sections:
 - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 - 1. Seismic Hazard Level as stated on contract documents.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Sealants and gaskets.
 - 2. Seismic-restraint devices.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Equipment installation based on equipment being used on Project.
 - 10. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 11. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 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.
 - f. Perimeter moldings.
- B. Welding certificates.
- C. Field quality-control reports.

1.06 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 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. Lindab Industries, Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.

- d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
 - f. Eastern Sheet Metal.
 - g. Hamlin Sheet Metal.
 - h. Turn Key Duct Systems.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 DOUBLE-WALL ROUND DUCTS AND FITTINGS

- 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. Lindab Inc.
 2. McGill AirFlow LLC.
 3. SEMCO Incorporated.
 4. Sheet Metal Connectors, Inc.
 5. Hamlin Sheet Metal.
 6. Turn Key Duct Systems.
- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved,

duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 3. Coat insulation with antimicrobial coating.
 4. Cover insulation with polyester film complying with UL 181, Class 1.
- E. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.04 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Factory- or Shop-Applied Antimicrobial Coating:
 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
 2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

5. Shop-Applied Coating Color: Black or White.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.05 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg , positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F .
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg , positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.
 3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. Maximum Static-Pressure Class: 10-inch wg , positive or negative.
 9. Service: Indoor or outdoor.
 10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
 1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.

5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch , plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches .
- K. Where ducts pass through non-fire-rated, interior partitions, fill void between duct and opening in wall with fiberglass insulation and sealant for acoustical separation.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible": See schedule.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with requirements indicated in Seismic Specification.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- F. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.06 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:
 - a. Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Test for leaks before applying external insulation.
 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 6. Give five days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 1. Visually inspect duct system to ensure that no visible contaminants are present.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.09 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Ductwork

Table 1: Recommended Ductwork Seal Levels by Duct Type (Current ASHRAE Handbook – Fundamentals)

Duct Location	Supply (less than or equal to 2 in-wg)	Supply (greater than 2 in-wg)	Exhaust	Return
Outdoors	A	A	A	A
Unconditioned Spaces	B	A	B	B
Conditioned Spaces (concealed ductwork)	C	B	B	C
Conditioned Spaces (exposed ductwork)	A	A	B	B

Table 2: Duct Leakage Classification (Current ASHRAE Handbook – Fundamentals)

Duct Type	Sealed	Unsealed
Metal (flexible excluded) – Round and flat oval	3	30
Metal – Rectangular (less than or equal to 2 in-wg)	12	48
Metal – Rectangular (greater than 2 in-wg)	6	48
Flexible (metal, aluminum)	8	30

- C. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 - 3. Aluminum Ducts: Aluminum.
- D. Double-Wall Duct Interstitial Insulation:
 - 1. Supply Air Ducts: 1 inch thick.
 - 2. Return Air Ducts: 1 inch thick.
 - 3. Exhaust Air Ducts: 1 inch thick.
- E. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 2. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows." Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity (less than 2 in-wg)1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm : Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

**SECTION 233300
AIR DUCT ACCESSORIES**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Fire dampers.
 - 3. Flange connectors.
 - 4. Turning vanes.
 - 5. Duct-mounted access doors.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.

1.03 ACTION SUBMITTALS

- A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Duct-mounted access doors.
 - d. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

1.01 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1.02 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

1.03 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Standard leakage rating, with linkage outside airstream.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames:
 - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 5. Blade Axles: Galvanized steel.
 - 6. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 7. Tie Bars and Brackets: Galvanized steel.

1.04 FIRE DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Arrow United Industries; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. Nailor Industries Inc.
 - 6. NCA Manufacturing, Inc.
 - 7. Pottorff.
 - 8. Prefco; Perfect Air Control, Inc.
 - 9. Ruskin Company.
 - 10. Vent Products Company, Inc.
 - 11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.024-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- K. Heat-Responsive Device: Replaceable link and switch package, factory installed, 165 deg F rated.

1.05 FLANGE CONNECTORS

- A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

1.06 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.
- E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

1.07 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

1.08 DUCT ACCESS PANEL ASSEMBLIES

- A. Labeled according to UL 1978 by an NRTL.
- B. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.
- C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- E. Minimum Pressure Rating: 10-inch wg, positive or negative.

1.09 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

- E. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

1.010 FLEXIBLE DUCTS

- A. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- B. Flexible Duct Connectors:
 - 1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

1.011 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

1.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream and downstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. At each change in direction and at maximum 50-foot spacing.
 7. Upstream and downstream from turning vanes.
 8. Control devices requiring inspection.
 9. Elsewhere as indicated.
- G. Install access doors with swing against duct static pressure.
- H. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- I. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- J. Install flexible connectors to connect ducts to equipment.
- K. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- L. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- M. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- N. Install duct test holes where required for testing and balancing purposes.
- O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

1.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Inspect turning vanes for proper and secure installation.

END OF SECTION

**SECTION 23 34 13
HVAC FANS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Centrifugal roof ventilators.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, furnished specialties, and accessories for each fan.
 - 2. Certified fan performance curves with system operating conditions indicated.
 - 3. Certified fan sound-power ratings.
 - 4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 5. Material thickness and finishes, including color charts.
 - 6. Dampers, including housings, linkages, and operators.
 - 7. Fan speed controllers.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Delegated-Design Submittal: For unit hangers and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- D. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements. 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. Ceiling suspension assembly members.
 - 2. Size and location of initial access modules for acoustical tile.
 - 3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels and special moldings.
- B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For axial fans to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.08 COORDINATION

- A. Coordinate size and location of structural-steel support members.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. AMCA Compliance:
 - 1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
 - 2. Operating Limits: Classify according to AMCA 99.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. PennBarry.
 - 4. Or Approved Equal.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
 - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
 - 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 - 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 - 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - 5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
- E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange, Built-in cant and mounting flange, or Built-in raised cant and mounting flange.
 - 2. Sound Curb: Curb with sound-absorbing insulation.
 - 3. Pitch Mounting: Manufacture curb for roof slope.
 - 4. Metal Liner: Galvanized steel.
 - 5. Mounting Pedestal: Galvanized steel with removable access panel.
 - 6. Vented Curb: Unlined with louvered vents in vertical sides.

2.04 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
- B. Enclosure Type: Totally enclosed, fan cooled.

2.05 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- E. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- F. Install units with clearances for service and maintenance.
- G. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- H. Unit Support: Install centrifugal fans level on structural curbs or pilings. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

3.02 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Install ducts adjacent to fans to allow service and maintenance.
- E. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system.
 5. Adjust damper linkages for proper damper operation.
 6. Verify lubrication for bearings and other moving parts.
 7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 8. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 9. Shut unit down and reconnect automatic temperature-control operators.
 10. Remove and replace malfunctioning units and retest as specified above.
- D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Lubricate bearings.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fans.

END OF SECTION

SECTION 23 37 13
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Perforated diffusers.
 - 3. Round plaque diffusers
- B. Related Sections:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.
- B. Source quality-control reports.

PART 2 - PRODUCTS

- 2.01 Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings or equal.**

- 2.02 Refer to drawings**

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels,

locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

**SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL**

PART 1 GENERAL

1.01 IMPOSED REGULATIONS

- A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for electrical work: codes and standards listed on the electrical drawings.

1.02 SCOPE OF WORK

- A. Provide all labor, materials, equipment and supervision to construct complete and operable electrical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.03 RELATED DOCUMENTS AND OTHER INFORMATION

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

1.04 EXISTING SERVICES AND FACILITIES

- A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.
- B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.
- C. Removed Materials: Existing materials made unnecessary by the new installation shall be stored on site. They shall remain the property of the Owner and shall be stored at a location and in a manner as directed by the Owner. If classified by the Owner's authorized representative as unsuitable for further use, the material shall become the property of the Contractor and shall be removed from the site at no additional cost to the owner.

1.05 PRODUCT WARRANTIES

- A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.06 PRODUCT SUBSTITUTIONS

- A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of

the Architect at least 10 days prior to opening of bids.

1.07 ELECTRICAL DRAWINGS

- A. Electrical contract drawings are diagrammatic and indicate the general arrangement of electrical equipment. Do not scale electrical plans. Obtain all dimensions from the Architect's dimensioned drawings and field measurements. The Contractor shall review Architectural plans for door swings and built-in equipment; conditions indicated on those plans shall govern for this work.
- B. Coordinate installation of electrical equipment with the structural and mechanical equipment and access thereto. Coordinate exterior electrical work with civil and landscaping work.
- C. Discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions shall be installed to provide the better quality or greater quantity of work; or, comply with the more stringent requirement; either or both in accordance with the A/E's interpretation.

1.08 SYSTEMS REQUIRING ROUGH-IN

- A. Rough-in shall consist of all outlet boxes/raceway systems/supports and sleeves required for the installation of cables/devices by other Divisions and by the Owner. It shall be the responsibility of this Contractor to determine the requirements by reviewing the contract documents and meeting with the Superintendent of the trade involved and Owner's representative to review submittal data, shop drawings, etc.
- B. Sealing of all sleeves, to meet the fire rating of the assembly, whether active or not, is work of this Division.

1.09 SUBMITTALS

- A. Refer to section 260510

PART 2 PRODUCTS

2.01 FIRESTOPPING

- A. Refer to Division 07 sections for additional requirements.
- B. A firestop system shall be used to seal penetrations of electrical conduits and cables through fire-rated partitions per the NEC. The firestop system shall be qualified by formal performance testing in accordance with ASTM E-814, or UL 1479.
- C. The firestop system shall consist of a fire-rated caulk type substance and a high temperature fiber insulation. It shall be permanently flexible, waterproof, non-toxic, smoke and gas tight and have a high adhesion to all solids so damming is not required. Only metal conduit shall be used in conjunction with this system to penetrate fire rated partitions. Install in strict compliance with manufacturer's recommendations. 3M, Hilti, STI or equal
- D. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- E. Comply with BICSI TDMM, "Firestopping Systems" Article.

PART 3 EXECUTION

3.01 PRODUCT INSTALLATION, GENERAL

- A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.
- B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.
- C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect five days in advance of any testing.
- D. Install temporary protective covers over equipment enclosures, outlet boxes and similar items after interiors, conductors, devices, etc. are installed, to prevent the entry of construction debris and to protect the installation during finish work performed by others. Do not install device plates, equipment covers or trims until finish work is complete.
- E. Clean all equipment, inside and out, upon completion of the work. Scratched or marred surfaces shall be touched-up with touch-up paint furnished by the equipment manufacturer.
- F. Replace all equipment and materials that become damaged.
- G. No more than three phase conductors, each of opposite phases for a three phase WYE system, shall be combined in a single raceway unless written approval is granted by the engineer or noted otherwise on the construction documents. (For 120 volt and 277 volt receptacle and lighting circuits are no more than 3 circuits unless written approval is granted by the engineer or noted otherwise on the construction documents.)

3.02 LOW VOLTAGE CABLING SEPARATION FROM EMI SOURCES

- A. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
- B. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches
- C. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches
- D. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches

3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches

- E. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches
- F. Separation between Cables and light fixtures: A minimum of 5 inches

3.03 EQUIPMENT PROTECTION

- A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
- B. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.
- C. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
- D. Damaged equipment shall be, as determined by the Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
- E. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
- F. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

3.04 UTILITY CONNECTIONS

- A. Coordinate the connection of the electrical system with the local power company. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Pay all utility fees and charges.

3.05 ELECTRICAL WORK

- A. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
 - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
 - 2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
 - 3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the Contractor. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.

This plan is subject to review and comment by the owner.

- B. Nothing in the above shall impose any duty on the Architects and Architect's consultants, nor relieve the General Contractor and its subcontractors of its obligations, duties and responsibilities including but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordinating the Electrical Work in accordance with the Contract Documents and any health or safety precautions required by any regulatory agencies.

END OF SECTION

**SECTION 26 05 01
ELECTRICAL DEMOLITION**

PART 1 GENERAL

1.01 Not Used

PART 2 PRODUCTS

2.01 Not Used

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field verify measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation.
- D. Report discrepancies to Engineer before disturbing existing installation.
- E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Existing Fire Alarm System: Maintain existing system in service until new system is installed and tested. Disable system only to make switchovers and connections. Minimize outage duration. Notify owner and AHJ before partially or completely disabling system.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Maintain electrical service to areas outside of the construction area.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.

- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- L. All demolished ballasts and lamps shall be recycled.
- M. Remove all abandoned conductors and cables within the construction area.
- N. Support all existing communication cables within the construction area.
- O. Provide fire stopping for all existing communication conduit fire rated wall penetrations within the construction area.

3.04 CONSTRUCTION PHASING

- A. Plan and execute the work in accordance with the construction phasing indicated on the Architectural plans. Test and certify all systems, by phase of construction, so that "partial occupancy" can be obtained.

3.05 REUSE OF EXISTING MATERIALS

- A. Where new devices are to replace existing, it shall be permissible to reuse existing outlet boxes and branch circuit conduits. It shall be the responsibility of the Contractor to ensure that existing outlet boxes and conduits that are reused comply with requirements for new.
- B. The reuse of conduits (not remaining in place), conductors, and devices is not permitted.

3.06 CUTTING AND PATCHING

- A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Engineer's written authorization. Authorization will be granted only when there is no other reasonable method for completing the electrical work, and where the proposed cutting clearly does not materially weaken the structure.
- B. Cutting Concrete: Where authorized, cut openings through concrete (for conduit penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill. Prior to cutting of existing concrete walls, floors, or ceilings x-ray existing concrete to locate existing hidden utilities.
- C. Other Work: Do not endanger or damage other work through the procedures and process of cutting to accommodate electrical work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.
- D. Patching: Where patching is required to restore other work, because of cutting or other damage inflicted during the installation of electrical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finished, as judged by the Engineer. Engage the original Installer to complete patching of various categories of work including: concrete and masonry finishing, waterproofing and roofing, exposed wall finishes, etc.

3.07 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions.

3.08 LABELING

- A. Provide typed circuit directory showing revised circuiting arrangement.
- B. Provide and install a new engraved nameplate for all electrical panels that have been modified during construction. Refer to the panelboard specification section for labeling requirements.

END OF SECTION

SECTION 260502 - ELECTRICAL ACCEPTANCE TESTS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Refer to section 260510.

1.2 References

- A. ANSI/NETA ATS, "Standard for Acceptance Testing Specifications, current edition.

1.3 SCOPE OF WORK

- A. Acceptance tests shall be performed in accordance with the current version of ANSI/NETA ATS
- B. Tests shall be performed in accordance with applicable codes, standards, and equipment manufacturers' instruction.
- C. The Contractor shall provide all test equipment, materials and labor necessary to perform the tests, and shall coordinate with the other trades for necessary services, such as scaffolding and the uncoupling of motors.
- D. Tests shall consist of visual inspections, manual operations, and electrical testing under all normal and expected abnormal operating conditions.
- E. The Owner shall be notified at least 2 weeks in advance of all tests.
- F. The Engineer shall be provided with a written test report, signed and dated, for all tests.
- G. Acceptance testing shall be provided and reviewed by the Engineer prior to energizing of electrical equipment. Phasing may require multiple trips/tests/reports and after hours work.

1.4 TESTING CRITERIA

- A. High potential tests shall be performed at the AC or DC voltage listed in ANSI/NETA ATS unless specified otherwise herein. Do not perform more than one high potential test on any item without authorization from the Owner.
- B. Dielectric absorption tests shall be performed with a 2,500 volt DC megger.
- C. Megger tests shall be performed at a DC voltage of 1,000 volts for 600 volt rated equipment, and at a DC voltage of 500 volts for 120-300 volt rated equipment.
- D. Continuity checks shall be performed with a low voltage DC meter, light or bell.
- E. The resistance to ground shall be measured using either the three point method or the fall of potential method.
- F. Test instruments shall be calibrated to national standards to ensure the accuracy of tests.

These calibration reports shall be made available to the Owner when requested. Depending upon frequency of use, the instruments shall be calibrated at least every 12 months.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 VISUAL INSPECTIONS

- A. Prior to manual operation and electrical testing, verify the following:
1. The equipment is free from damage and defects.
 2. The equipment has been lubricated.
 3. The ventilation louvers are open and unobstructed.
 4. Electrical connections have been tightened.
 5. Voltages, phases, and rotation have been identified.
 6. Terminations have been identified.
 7. Equipment labels have been installed.
 8. The equipment has been calibrated.
 9. The equipment is ready to be electrically tested

3.2 MANUAL OPERATIONS

- A. Prior to electrical testing, verify the following:
1. Mechanical components operate smoothly and freely.
 2. Mechanical stops, limit switches, etc., are properly adjusted.

3.3 ELECTRICAL ACCEPTANCE TESTS

- A. 600 Volt Power Cables
1. A continuity check and a 1,000 volt DC megger test shall be performed on 600 volt power cables No. 4 AWG and larger. The megger test shall be performed between each pair of conductors and from each conductor to ground. Each test shall be performed for 15 seconds or until the insulation resistance value stabilizes.
 - a. The insulation resistance between conductors, and from each conductor to ground, shall be 100 megohms minimum in one minute or less. In addition, the lowest insulation resistance value shall not differ from the highest value by more than 20 percent. If all megger readings for a given circuit are above 1000-megohms, the 20 percent balance requirement may be waived.
 - b. Proper rotation shall be verified.
- B. Control Cable
1. A continuity check shall be performed on control and instrumentation wiring.

END OF SECTION 260502

**SECTION 26 05 10
ELECTRICAL SUBMITTALS**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Comply with the applicable requirements of the Division 1 specifications (013300) and the requirements of this Division of the specifications.

1.02 SUBMITTALS

- A. Submit for review by the Engineer Architect a schedule with engineering data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive materials, i.e., catalog sheets, product data sheets, diagrams, performance curves and charts published by the manufacturer, warranties, etc., to show conformance to Specifications and Plan requirements; model numbers alone shall not be acceptable. Data submitted for review shall contain all information to indicate compliance with Contract Documents. Complete electrical characteristics shall be provided for all equipment. Submittals for lighting fixtures shall include Photometric Data. The Engineer reserves the right to require samples of any equipment to be submitted for review.
- B. The purpose of shop drawing review is to demonstrate to the Architect that the Contractor understands the design concept. The Architect's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviations from the drawings or specifications unless he has, in writing, called the Architect's attention to such deviation at the time of submission, and received written permission from the Architect for such deviations.
- C. Where cut sheets include an entire product family, mark all specific items to be utilized for this project on equipment cut sheets. Generic cut sheets with no indication of which items on the cut sheet shall be used will be rejected.
- D. Response to Submittals: Shop drawings shall be returned by the Electrical Engineer with the following classifications:
 - 1. "No Exceptions Taken": No corrections, no marks. Contractor shall submit copies for distribution
 - 2. "Make Corrections Noted": A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.
 - 3. "Amend and Resubmit": Minor corrections. Item may be ordered at the Contractor's risk. Contractor shall resubmit drawings with corrections noted.
 - 4. "Rejected - Resubmit": Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.
- E. Prior Approvals and Shop Drawings must be hand delivered, received by mail, or email.
- F. Equipment and materials requiring submittals:
 - 1. Section 260500 – Common Work Results for Electrical
 - a. Product Warranties
 - b. Firestopping Materials
 - 2. Section 260502 – Electrical Acceptance Tests

- a. Test Reports
3. Section 260511 – Electrical Work Closeout
 - a. Record Drawings
 - b. Record Manuals
 - c. Close out submittals
4. Section 260512 – Electrical Coordination
 - a. Coordination Affidavit
 - b. Electrical Coordination Drawings
5. Section 260519 – Low-Voltage Electrical Conductors and Cables
 - a. Splice Kits
 - b. Waterproof Wire Connectors
 - c. Wire
 - d. Field Quality Control Test Reports
6. Section 260526 – Grounding and Bonding for Electrical Systems
 - a. Grounding Connections
 - b. Ground Wire
 - c. Field Quality Control Test Reports
7. Section 260529 – Hangers and Supports for Electrical Systems
 - a. Product Data
8. Section 260533 – Raceway and Boxes for Electrical Systems
 - a. Raceway
 - b. Boxes
 - c. Enclosure ratings
 - d. Dimension data
 - e. Floor Boxes
 - f. Corrosion Protection
 - g. Surface Metallic/Nonmetallic Raceway
9. Section 260548 – Vibration and Seismic Controls for Electrical Systems
 - a. Submit seismic force level (F_p) calculations from applicable building code.
 - b. Submit pre-approved restraint selections and installation details
 - c. Restraint selection and installation details shall be sealed by a professionally licensed engineer experienced in seismic restraint design.
 - d. Submit manufacturer's product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns. For each different strut cross-section, submit cross sectional properties including Section Modulus (S_x) and Moment of Inertia (I_x).
 - e. Field reports
10. Section 260553 – Identification for Electrical Systems
 - a. Product data for all labeling products
 - b. Samples of device nameplates
11. Section 262400 – Panelboards
 - a. Circuit breaker product data
12. Section 262726 – Wiring Devices
 - a. Product data
 - b. Device Plates
 - c. Special Purpose Receptacles

- d. Dimmer Switches
- e. Occupancy Sensors
- f. Device and device plate colors

- 13. Section 265100 – Lighting
 - a. Lighting Fixtures
 - b. Emergency Ballasts

PART 2 PRODUCTS

2.01 Not Used.

PART 3 EXECUTION

3.01 MANUFACTURER'S DATA

- A. Include the manufacturer's comprehensive product data sheet and installation instructions. Where operating ranges are shown, mark data to show portion of range required for project application. Where pre-printed data sheet covers more than one distinct product-size, type, material, trim, accessory group or other variations, delete or mark-out portions of the pre-printed data which are not applicable.

3.02 EQUIPMENT LIST

- A. Where more than one type of a product is being used (i.e. starters, disconnects, breakers, etc.) provide a list with each submittal correlating the type and size of product to the load served.

3.03 TEST REPORTS

- A. Submit test reports which have been signed and dated by the firm performing the tests, and prepare in the manner specified in the standard or regulation governing the tests procedure as indicated.

END OF SECTION

**SECTION 26 05 11
ELECTRICAL WORK CLOSEOUT**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to section 260510.

1.02 RELATED SECTIONS

- A. Refer to section 017839 for additional requirements.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

- A. Except where otherwise indicated, electrical drawings prepared by Engineer are diagrammatic in nature and may not show locations accurately for various components of electrical system. Shop drawings, including coordination drawings, prepared by the Contractor show portions of work more accurately to scale and location, and in greater detail. It is recognized that actual layout of installed work may vary substantially from both Contractor drawings and shop drawings.
- B. The electrical superintendent shall maintain a white set of contract documents and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. PDF or digital mark-ups is acceptable alternates Mark-up whatever drawings are most capable of showing installed conditions accurately. However, where shop drawings are marked, record a reference note on appropriate contract drawings. Mark with erasable pencil, and use multiple colors to aid in the distinction between work of separate electrical systems. These documents shall be used for no other purpose. In general, record every substantive installation of electrical work which previously is either not shown or shown inaccurately, but in any case record the following:
 - 1. Post all addenda prior to beginning work.
 - 2. Underground feeder conduits, both interior and exterior, drawn to scale and fully dimensioned.
 - 3. Work concealed behind or within other work, in a non-accessible arrangement.
 - 4. Mains and branches of wiring systems, with panelboards and control devices located and numbered, with concealed splices located, and with devices requiring maintenance located.
 - 5. Scope of each change order (C.O.), noting C.O. number.
- C. Upon each visit by the Architect/Engineer, the Contractor shall demonstrate that the record documents are being kept current, as specified hereinbefore.

2.02 RECORD MANUALS

- A. Record manuals shall include the following:
 - 1. Manufacturer's operation and maintenance manuals for:
 - a. Light Fixtures
 - b. Breakers
 - c. Fire Alarms
 - 2. Shop drawings, revised to reflect all review comments, supplemented with the installation instructions shipped with equipment.

3. One copy of all panelboard directories.
 4. All field test Reports
 5. Electrical Contractor's Warranty
- B. Submit record manuals in quantities and in the format prescribed in the Division 1 specifications.

2.03 CLOSEOUT SUBMITTALS

- A. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On USB drive, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

PART 3 EXECUTION

3.01 SITE VISITS

- A. At all construction observations by the Architect/Engineer, the Contractor shall demonstrate to the Architect/ Engineer that all work is complete in accordance with the contract documents and that all systems have been tested and are fully operational. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.

END OF SECTION

**SECTION 26 05 12
ELECTRICAL COORDINATION**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to section 260510.

PART 2 PRODUCTS

2.01 EQUIPMENT REQUIRING ELECTRICAL SERVICE

- A. Provide electrical connections for all electrically driven equipment. Final connections are electrical work, except as otherwise noted. Obtain a copy of the shop drawings of equipment. Review shop drawings to verify electrical characteristics and to determine rough-in requirements, final connection requirements, location of disconnect switch, etc. Notify the General Contractor if the information received is ambiguous or incomplete. Keep a copy of these shop drawings at the project site throughout the course of construction.
- B. Equipment to be connected includes, but is not limited to the following:
1. HVAC Equipment
 2. Fire Protection Equipment
 3. Fire Alarms
- C. The design of circuits for electrically driven equipment is based on the product of one manufacturer and may not be representative of all acceptable manufacturers. If equipment furnished has differing characteristics, make necessary adjustments to circuit components at no additional cost to the Owner, subject to the approval of the Engineer.
- D. Provide motor starters and disconnects for all mechanical equipment unless provided by the mechanical contractor.

PART 3 EXECUTION

3.01 COORDINATION OF MECHANICAL INSTALLATION:

- A. Attachment Number 1 shall be filled out and returned with shop drawing submittals. The intent of Attachment Number 1 is to ensure that the electrical requirements for equipment have been reviewed and coordinated by the Contractor. No electrical equipment shall be ordered, nor shall rough-in begin, before this coordination has taken place. This document shall be returned appropriately marked whether or not any changes are deemed to be necessary by the contractor.

ATTACHMENT NO. 1

SHOP DRAWING COORDINATION AFFIDAVIT

I, the undersigned, certify that I have reviewed the equipment shop drawings for electrically driven equipment and that the accompanying electrical shop drawings reflect the requirements of the actual equipment to be furnished for use on this project. The following deviations from design drawings were required to serve the furnished equipment:

ITEM	CKT.DESIG.		BKR.SIZE		CONDUIT/WIRE		DISC.SIZE		STARTER	
	New	Old	New	Old	New	Old	New	Old	New	Old

NOTE: If no deviations are required please indicate by circling the appropriate answer above your signature.

PROJECT: _____ DEVIATIONS: Yes / No

COMPANY: _____

TITLE: _____ SIGNATURE: _____

TELEPHONE: _____ DATE: _____

IT IS THE RESPONSIBILITY OF THE DIVISION 26 CONTRACTOR TO OBTAIN SHOP DRAWING INFORMATION FROM OTHER TRADES. FAILURE TO PERFORM THE WORK REQUIRED BY THIS AFFIDAVIT, PRIOR TO ORDERING MATERIALS OR ROUGHING-IN, MAY RESULT IN IMPROPER CONNECTIONS BEING PROVIDED. THE EXPENSE OF CORRECTIVE MEASURES, IF REQUIRED, SHALL BE BORNE BY THE CONTRACTOR.

NOTE:
PANELBOARD SHOP DRAWINGS WILL NOT BE REVIEWED UNTIL THE ELECTRICAL CONTRACTOR COMPLETES AND SUBMITS THIS AFFIDAVIT TO THE ELECTRICAL ENGINEER.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the requirements for the following:
 - 1. Wire and cable for 600 volts and less.
 - 2. Wiring connectors and connections.

1.02 SUBMITTALS

- A. Refer to section 260510.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

- A. Concealed Dry Interior Locations: Use only THHN-2, THWN-2 or XHHW-2 wire in raceway.
- B. Exposed Dry Interior Locations: Use only THHN-2, THWN-2, or XHHW-2 in raceway.
- C. Above Accessible Ceilings: Use only THHN-2, THWN-2, or XHHW-2 in raceway.
- D. Wet or Damp Interior Locations: Use only THWN-2 or XHHW-2 in raceway.
- E. Exterior locations (above or below grade) THWN-2, XHHW-2 or USE in raceway.
- F. Use conductors not smaller than 12 AWG for power and lighting circuits.
- G. Use conductors not smaller than 14 AWG for control circuits.
- H. Metal Clad (MC) cable can be used for 20 Amp branch circuits, when installed in concealed indoor locations. and not used for home runs.

2.02 BUILDING WIRE

- A. Conductor: Copper.
- B. Insulation Voltage Rating: 600 volts.

- C. Temperature Rating: 90°C.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Pull all conductors into raceway at same time.
- B. Use suitable wire pulling lubricant for building wire 4 AWG and larger. Do not exceed manufacturers recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- E. Clean conductor surfaces before installing lugs and connectors.
- F. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- G. Use split bolt connectors or compression fittings for splices and taps on conductors 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- H. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- I. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values or UL 486A and UL 486B.
- K. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- L. For each electrical connection/termination, provide a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other materials necessary to complete splices and terminations. Torque all connections according to installation instructions.
- M. Motor connections shall be made with compression connectors forming a bolted in-line or stub-type connection.
- N. Splicing of feeder conductors shall not be acceptable, unless specifically indicated on the drawing. Where splicing of feeder conductors is indicated, splices shall be made using compression type butt splice.
- O. All splices made underground or in the pipe basements shall be rated suitable for water immersion.
- P. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual

- conductors or cables supported. Body shall be malleable iron.
- Q. All MC cable shall be installed perpendicular or parallel to building structure and supports at intervals of 5 feet or less.
- R. Cable ties shall not be used to support MC cables.

3.02 LABELING

- A. Color Coding
1. Color shall be green for grounding conductors and green with yellow stripe for isolated grounding conductors.
 2. The color of the circuit conductors shall be as follows:

120/208 volt, 3-phase	Phase A - Black
	Phase B - Red
	Phase C - Blue
	Neutral - White

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Grounding and bonding components.
- B. Provide all components necessary to complete the grounding system(s) consisting of:
 - 1. Existing and new metal underground water pipe.
 - 2. Metal frame of the building.
 - 3. Steel water storage tank and supports.
 - 4. Concrete-encased electrode.

1.02 SUBMITTALS

- A. Refer to section 260510.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.04 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; current edition.
- B. NFPA 99 - Standard for Health Care Facilities; National Fire Protection Association; current edition.
- C. IEEE Standard 142 "Green Book" – Recommended Practices for Grounding of industrial and Commercial Power Systems; current edition.

1.05 PERFORMANCE REQUIREMENTS

- A. Maximum grounding system resistance: 15 ohms.

PART 2 PRODUCTS

2.01 CONDUCTORS

- A. Bonding Jumper Braid: Copper braided tape, sized for application.
- B. Electrical Grounding conductors: Unless otherwise indicated, provide bare or green insulated stranded copper electrical grounding conductors sized according to NEC or as shown or specified. Provide green insulated for conductors sized No. 10 AWG and smaller.

2.02 GROUND CONNECTIONS

- A. Below Grade: Exothermic-welded type connectors.
- B. Above Grade:
 - 1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers.

2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
 3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.
- C. Install exothermic connectors and terminals as recommended by the connector and terminal manufacturer for intended applications.
- D. Bolted clamp will not be accepted between grounding rods and ground conductors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.
- B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 SECONDARY EQUIPMENT AND CIRCUITS

- A. Panelboards; Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- B. Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits, sized in accordance with Article 250 of NFPA 70.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- D. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- E. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
- F. Metallic Conduit: Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical grounding system, test resistance of each ground rod installation using the "Fall of Potential" method. Ground resistances shall be measured in normally dry conditions not less than 48 hours after rainfall and at low tide. Where tests show resistance to ground is over the specified value, take appropriate action to reduce resistance by driving additional sections of ground rods and then retest to demonstrate compliance. Tests shall be conducted in the presence of the Project Electrical Engineer. Provide forms to

record the data as the tests are conducted. Forms shall be signed by the person conducting the test and included with project closeout documents.

END OF SECTION

**SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the requirements for the following:
 - 1. Conduit and equipment supports.
 - 2. Anchors and fasteners.

1.02 SUBMITTALS

- A. Refer to section 260510.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

PART 2 PRODUCTS.

2.01 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:
 - 1. Do not use powder-actuated anchors.
 - 2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
 - 3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
 - 4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
 - 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
 - 6. Solid Masonry Walls: Use expansion anchors or preset inserts.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- B. Cutting or Holes:
 1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Architect prior to drilling through structural sections.
 2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Architect as required by limited working space.
- C. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- D. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- E. In wet and damp locations use steel channel supports to stand cabinets, disconnects and panelboards 1 inch (25 mm) off wall.
- F. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- G. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- H. Use adjustable steel channel fasteners for hung ceiling outlet box.
- I. Do not fasten boxes to ceiling support wires.
- J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- K. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- L. Do not support conduit with wire, wire ties, or perforated pipe straps. Remove wire used for temporary supports.
- M. Do not attach conduit to ceiling support wires.

END OF SECTION

**SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to section 260510

1.02 QUALITY ASSURANCE

- A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); current edition
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); current edition
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); current edition
- D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition
- E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; current edition
- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; current edition

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Conduit Size: Comply with NFPA 70.
 - 1. Minimum Size: 3/4 inch
- B. Wet and Damp Locations:
 - 1. Exterior above ground and in pipe basements: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
 - 2. Interior: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
 - 3. Interior below grade: RNC schedule 40/80
 - 4. Where RNC Schedule 40 is installed below grade or under floor slabs, the elbows

required to turn the raceway up through the slab shall be RMC.

- C. Dry Locations:
 - 1. Concealed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
 - 2. Exposed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
- D. Area subject to physical damage: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
 - 1. "Areas subject to physical damage" shall be defined as the most stringent of the following:
 - a. Exposed conduit below eight feet above finished floor.
 - b. As interpreted by the authority having jurisdiction (AHJ).

2.02 METAL CONDUIT

- A. Rigid Steel Galvanized Conduit (RMC): ANSI C80.1.
- B. Intermediate Metal Conduit (IMC): ANSI C80.6.
- C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.
 - 1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
 - 2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
 - 3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
 - 4. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - 5. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - 6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2.03 FLEXIBLE METAL CONDUIT

- A. FLEXIBLE METAL CONDUIT (FMC) Description: Interlocked steel construction. Flexible metal conduit shall conform to UL 1.
- B. Fittings: NEMA FB 1.
 - 1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
 - 2. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
 - 3. Clamp type, with insulated throat.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) Description: Interlocked steel construction with PVC jacket. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
- B. Fittings: UL 514B and ANSI/ NEMA FB1.

1. Only steel or malleable iron materials are acceptable.
2. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

2.05 ELECTRICAL METALLIC TUBING

- A. ELECTRICAL METALLIC TUBING (EMT) Description: ANSI C80.3
- B. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.
 1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
 2. Only steel or malleable iron materials are acceptable.
 3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
 4. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50mm (2 inches) and smaller.
 5. Indent type connectors or couplings are prohibited.

2.06 NONMETALLIC CONDUIT

- A. RIGID NONMETALLIC CONDUIT (RNC): Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
- B. RNC: NEMA TC 2, schedule 80 PVC
- C. Fittings shall meet the requirements of UL 514C and NEMA TC3
- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.07 CORROSION PROTECTION

- A. Corrosion protection for conduits passing through concrete slabs shall be by one of the following means: field-wrapped with 3M Scotchrap No. 50, 2-inch wide (minimum), with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating.

2.08 FLOOR BOXES:

- A. For slab on grade locations (non-furniture feed applications): Evolution Series floor box by Legrand or comparable product by one of the following, contingent upon compliance with the Contract Documents:
 1. Hubbell Wiring Systems
 2. FSR Inc.
- B. For all other locations (non-furniture feed applications): Evolution Series poke-thru device by Legrand or comparable product by one of the following, contingent upon compliance with the Contract Documents:
 1. Hubbell Wiring Systems
 2. FSR Inc.

- C. All floor boxes and poke-thrus to be recessed service. Flush service boxes are not acceptable.
- D. All poke-thrus to be UL listed for installation in a 2-hour fire-rated floor.
- E. Provide floor boxes and poke-thrus with all necessary appurtenances to make a fully functioning system and incorporate wiring devices, low-voltage, and A/V connections indicated on plans.
- F. Cover to be UL listed for scrub water. Cover to have in-use hinged cable access doors. Finish of cover shall be selected by Architect and shall be compatible with specified floor finish or covering.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify routing and termination locations of conduit prior to rough-in.
- B. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to provide a complete wiring system.

3.02 CONDUIT INSTALLATION

- A. All fire alarm cable shall be installed in metallic conduit. Coordinate with fire alarm system manufacturer for cable routing and quantities.
- B. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 101.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.
- D. Arrange supports to prevent misalignment during wiring installation.
- E. Arrange conduit to maintain headroom and present neat appearance.
- F. Route exposed conduit parallel and perpendicular to walls.
- G. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- H. Route conduit in and under slab from point-to-point.
- I. Maintain adequate clearance between conduit and piping.
- J. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- K. Cut conduit square using saw or pipecutter; de-burr cut ends.
- L. Bring conduit to shoulder of fittings; fasten securely.
- M. For power conduits install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.

- N. For communication conduits install no more than the equivalent of two 90 degree bends between pull points. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.
- O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- P. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- Q. Seal the inside of all conduits where conduit passes below floor or outside of the building.
- R. Provide suitable pull string in each empty conduit except sleeves and nipples.
- S. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- T. Do not install FMC or LFMC in lengths over 6'.
- U. Use LFMC or FMC only to connect to equipment subject to vibration or to suspended light fixtures.
- V. Wherever possible, install horizontal raceway runs above water and drain piping. Give the right-of-way in confined spaces to piping that must slope for drainage and to larger HVAC ductwork and similar services that are less conformable than electrical services.
- W. Complete the installation of electrical raceways before starting installation of cables within raceways.
- X. Raceways shall not be installed exposed in finished spaces. Install concealed in walls, ceilings, below slab-on-grade or embedded in slabs above grade.

3.03 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Flush mounted.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 24 inch, center-to-center lateral spacing shall be maintained between boxes.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.
- F. Clean all debris out of floor boxes.

3.04 IDENTIFICATION

- A. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1"

- B. On all concealed junction box covers, identify the circuits with black marker. For exposed junction boxes use printed labels.

END OF SECTION

SECTION 26 05 48
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to section 260510.

1.02 QUALITY ASSURANCE

- A. Submittals must be signed and sealed shop drawings from a professional engineer licensed in the state that the project is located in. Shop drawings to include project specific details, sketches, product data cut sheets.
- B. The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping, conduit, cable trays and other similar systems and equipment where required by the applicable building code.
- C. System Supports/Restraints Manufacturers shall be firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.

PART 2 PRODUCT

2.01 SEISMIC BRACING

- A. General:
 - 1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
 - 2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 - 3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
 - 4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the details and notes on the construction documents
- B. Friction from gravity loads shall not be considered resistance to seismic forces.

PART 3 EXECUTION

2.02 INSTALLATION

- A. All seismic restraint systems shall be installed in strict accordance with the manufacturer's seismic restraint guidelines manual and all certified submittal data
- B. Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.
- C. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- D. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building.
- E. Prior to installation, bring to the architect's/engineer's attention any discrepancies between

- the specifications and the field conditions, or changes required due to specific equipment selection.
- F. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.
 - G. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.
 - H. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.
 - I. Provide reinforced clevis bolts where required.
 - J. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
 - K. Do not brace a system to two independent structures such as a ceiling and wall.
 - L. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement.
 - M. Provide seismic controls as required for all existing electrical items exposed during renovations.

2.03 FIELD QUALITY CONTROL

- A. Inspect all seismic supports after installation and submit a report from a professional engineer licensed in the state that the project is located in.

END OF SECTION

**SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to section 260510.

PART 2 PRODUCTS

2.01 NAMEPLATES AND LABELS

- A. Letter Size:
 - 1. Use 1/4 inch (6 mm) letters for identifying grouped equipment and loads.
- B. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background. Use only for identification of individual wall switches, receptacles, and control device stations. Labels shall identify the panel and circuit number (Ex: PANEL: CIRCUIT).
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - 5. Color: burgundy.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

- A. Install nameplates and labels parallel to equipment lines.
- B. Provide labels on all receptacles, light switches, and wall mounted occupancy sensors.

END OF SECTION

**SECTION 26 24 00
PANELBOARDS**

PART 1 GENERAL

1.01 SUBMITTALS

- A. See section 260510.

1.02 QUALITY ASSURANCE

- A. Where panelboards are used as service entrance equipment, they shall comply with all NEC and UL requirements for service entrance and a UL service entrance label shall be provided.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.
- B. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; current edition.
- C. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; current edition.

PART 2 PRODUCTS

2.01 CIRCUIT BREAKERS

- A. Provide molded case circuit breakers: Thermal magnetic trip circuit breakers.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
 - 4. Do not use tandem circuit breakers.
 - 5. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration for all residential applications.
 - 6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip). (where indicated)
- B. Circuit breakers serving fire alarm devices shall be provided with a red fire alarm circuit breaker lockout kit that permanently identifies circuit as "FIRE ALARM".
- C. Circuit breakers serving emergency communication devices (e.g. mass notification, area of refuge, two way communication) shall be provided with a circuit breaker locking device and be permanently identified as "EMERGENCY COMMUNICATIONS".

2.02 CONTROL WIRING

- A. Control wiring shall be 600 volt class B stranded SIS. Install all control wiring complete at the factory adequately bundled and protected. Wiring across hinges and between shipping units shall be Class C stranded. Size in accordance with NEC. Provide control circuit fuses. Provide integral power supply in switchgear for control power.

2.03 SHORT CIRCUIT CURRENT RATING:

- A. Devices which achieve the level of fault protection indicated by means of "series" or "integrated" rating shall not be acceptable unless specifically indicated on the drawings. All panelboards shall be fully rated.
- B. Minimum SSCR
 1. 208 Volt Panelboards: Minimum 10,000 amperes rms symmetrical unless noted otherwise on plans.
 2. Match existing equipment short circuit current ratings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide filler plates for unused spaces in panelboards.
- B. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- C. Do not splice conductors in panelboard enclosure.
- D. Piggy-back or tandem type breakers shall not be used.
- E. Multi-pole breakers shall be common trip, with a single handle.

3.02 ADJUSTING

- A. Touch-up scratched or marred surfaces to match original finish.
- B. Clean all debris from panel interiors.

3.03 LABELING

- A. Provide a typed legend for all modified or new electrical panels. Update the panel board schedules after load balancing.
- B. Identify load served and location by room names assigned by user, not by room numbers on floor plans. Note spares and spaces as such.
- C. Provide a laminated 11x17 one line diagram in the main electrical room mounted to the wall or main electrical panel.

3.04 CLEARANCE AND WORKSPACE

- A. Maintain workspace and clearances as required by the NEC for the voltage encountered. No pipes or ducts shall pass above the outline of the panelboard. It shall be the responsibility of this Contractor to make sure that other trades do not encroach on this space.

END OF SECTION

**SECTION 26 27 26
WIRING DEVICES**

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the requirements for the following:
 - 1. Receptacles.
 - 2. Device plates.
 - 3. Ceiling fan controllers
 - 4. Wall switches.
 - 5. Wall dimmers.
 - 6. Occupancy Sensors

1.02 SUBMITTALS

- A. Refer to section 260510.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.
- B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; current edition).
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; current edition.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Acceptable manufacturers, contingent upon compliance with the contract documents, are as listed below. Bidders shall carefully review the requirements listed in the technical specifications and only submit products that are equal or better. Equal products by other manufacturers are acceptable providing substitutions are submitted in accordance with requirements listed in the front end specifications and approved by the A/E. Bidders shall carefully review the front end documents and submit all information required to allow the A/E the ability to make a fully informed decision.
 - 1. Cooper Wiring Devices
 - 2. GE Industrial
 - 3. Leviton Manufacturing, Inc
 - 4. Hubbell, Inc
 - 5. Lutron Electronics Inc

6. Schneider Electric
7. Legrand – Pass & Seymour
8. C.W. Cole & Company
9. Acuity Brands Lighting, Inc

2.02 RECEPTACLES

- A. Receptacles: Specification grade complying with NEMA WD 6 and WD 1.
 1. Device Body: Color by architect, plastic, or Red for emergency power devices.
 2. Configuration: NEMA WD 6, type as specified and indicated.
 3. Type 5-20 or 5-15.
- B. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Feed through GFCI devices shall not be used. GFCI devices shall contain self-testing feature with power lockout if self-test fails.
- C. Special Purpose Receptacles: Provide heavy-duty type as indicated on the drawings.

2.03 WALL PLATES

- A. Cover Plates: Provide one piece wall plates for wiring devices, with ganging and cutouts as required. Provide blank wall plates for all un-used outlet boxes. Provide with metal screws for securing plates to devices, screw heads colored to match finish of plate. All plates shall be standard size, smooth stainless steel.
- B. Weatherproof Cover Plates: All devices installed outdoors and indoor devices specifically indicated, shall be provided with weatherproof covers. Covers shall be of the type that maintains weatherproof integrity when in-use and not in-use. Covers shall be listed and identified as “extra duty” type.

2.04 WALL SWITCHES

- A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
 1. Body and Handle: color by architect plastic with toggle handle, or red for emergency power devices.
 2. Ratings: Match branch circuit and load characteristics.
 3. Switch shall be rated for the horse power of the motor served.
- B. Switch Types: Single pole, double pole, 3-way.

2.05 WALL DIMMERS

- A. Electronic Wall Dimmers: Coordinate with electronic dimming ballast requirements.
 1. Body and Handle: plastic with slide adjuster.

2.06 OCCUPANCY SENSORS

- A. Wall switch sensors: Passive Infrared type.
 1. Capable of detection of occupancy at desktop level up to 300 sqft, and gross motion up to 1000 sqft with 180 degree coverage capability.
 2. Rating: Sensor rating shall be at least 125% of the connected load.
 3. Sensor shall utilize Zero Crossing Circuitry.
 4. Sensor shall have no leakage current to load, and voltage drop protection.
 5. Sensor shall provide high immunity to false triggering from RFI and EMI.
 6. Sensor shall be capable of operating normally with electronic ballasts, PL lamp

- systems and rated motor loads.
 - 7. Sensor shall utilize automatically adjustable time delay and sensitivity settings.
 - 8. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
 - 9. A bypass manual override shall be provided on each sensor.
 - 10. An integral photo cell with adjustable light level shall be provided
 - 11. All sensors shall have UL rated, 94V-0 plastic enclosures.
- B. Ceiling Sensors: Dual Technology type.
- 1. Rating: Sensor rating shall be at least 125% of the connected load.
 - 2. Sensor shall be ceiling mounted in such a way as to minimize coverage in unwanted areas.
 - 3. Sensor shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
 - 4. Passive Infrared Sensor shall provide high immunity to false triggering from RFI and EMI.
 - 5. Ultrasonic Sensor shall adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
 - 6. Sensor shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
 - 7. Sensor shall utilize automatically adjustable time delay and sensitivity settings.
 - 8. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
 - 9. A bypass manual override shall be provided on each sensor.
 - 10. All sensors shall have UL rated, 94V-0 plastic enclosures.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install devices plumb and level.
- C. Do NOT utilize back wiring on any wiring device.
- D. Install receptacles with grounding pole on top.
- E. Do not install receptacles within 6" of the edge of sinks.

- F. Connect wiring device ground terminal to outlet box with bonding jumper.
- G. All receptacles installed as listed below shall be GFCI type.
 - 1. Receptacles installed outdoors.
 - 2. Receptacles installed within six feet of sinks.
 - 3. Receptacles designated for electric drinking fountains.
 - 4. Receptacles designated for vending machines.
 - 5. Any other receptacles specifically indicated on the drawings.
 - 6. Receptacles installed in residential mechanical rooms.
- H. Install decorative plates in finished areas.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Install switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Do not share neutral conductor on load side of dimmers.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Verify that each receptacle device is energized.
- C. Test each receptacle device for proper polarity.
- D. Test each GFCI receptacle device for proper operation.
- E. Operate each wall switch with circuit energized and verify proper operation.
- F. Test each occupancy sensor and verify settings are appropriate for associated space.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. It shall be the contractor's responsibility to locate and aim occupancy sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.06 CLEANING

- A. It is anticipated that painting and other finish work may occur after device installation. Device plates shall not be installed until these activities are completed. Protect device and conductors by installing molded plastic cover.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

**SECTION 26 51 00
LIGHTING**

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the requirements for the following:
 - 1. Interior luminaires and accessories.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Luminaire accessories.

1.02 SUBMITTALS

- A. Refer to section 260510.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 REFERENCE STANDARDS

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; current edition.
- B. ANSI C78.377 – American National Standard for Electric Lamps – Specifications for the Chromaticity of Solid State Lighting Products.
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; current edition.
- D. IESNA LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.
- E. IESNA LM-80-08 – Approved Method: Measuring Lumen Maintenance of LED Light Sources.
- F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; current edition.
- G. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; current edition.
- H. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of design is as scheduled on drawings.

2.02 LUMINAIRES

- A. Furnish products as indicated in Schedule on plans.

1.05 EMERGENCY LED DRIVERS

- A. Regardless of catalogue number shown in fixture schedule, all fixtures indicated to be emergency type shall be provided with emergency type driver battery packs conforming to the following:
 1. Fixture Using Integral Emergency Driver/Battery Pack: Provide emergency driver installed within the fixture. The charging light and test switch shall be accessible/visible from below. Driver/Battery must be capable of operating fixture at 75% of fixture lumens for a minimum of 90 minutes. Drivers/batteries shall have full 5-year warranty.
 2. Fixture Using Remote Emergency Driver/Battery Pack: Provide Iota or Bodine emergency driver/battery pack installed remotely above accessible ceiling. Driver/Battery must be capable of operating fixture at 75% of fixture lumens for a minimum of 90 minutes. Drivers/batteries shall have full 5-year warranty.
- B. Integral emergency drivers/batteries shall be factory installed whenever possible.
- C. Drivers/batteries installed in fixtures located outdoors or unheated spaces shall be suitable for the ambient temperatures encountered or remotely located in a nearby accessible space.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Install recessed luminaires to permit removal from below.
- F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Install clips to secure recessed grid-supported luminaires in place.
- H. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.
- I. Install accessories furnished with each luminaire.
- J. Bond products and metal accessories to branch circuit equipment grounding conductor.

- K. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.02 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 ADJUSTING

- A. Aim and adjust luminaires as indicated.
- D. Position exit sign directional arrows as indicated.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate luminaire operation for minimum of two hours.

3.06 PROTECTION

- A. Replace/Repair luminaires that have failed at Substantial Completion.

END OF SECTION