PROJECT MANUAL

RENOVATE GENERAL'S QUARTERS – CAMP RAPID, B250 RAPID CITY CFMO# 466501

Prepared By: Department of the Military

2823 West Main Street Rapid City, South Dakota 57702 (605) 737-6637

August 2023

OWNER: State of South Dakota



This Project Manual provides for liquidated delay damages in the amount of **\$800.00** per calendar day for the Contractor's delay in completion of the work. See the Bid Form and Article 10 of the General Conditions for details.

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FOR

STATE SPECIFICATION

HEAD SECTIONS, GENERAL CONDITIONS, SPECIAL CONDITIONS, TECHNICAL SPECIFICATIONS AND PLANS

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INVITATION TO BID

Sealed bids will be received by the South Dakota Department of the Military at Joint Force Headquarters, building 420, Attn: Engineering Manager, 2823 W. Main Street, Rapid City, South Dakota, 57702 until 2:00 p.m. MT, **Thursday, September 21**, **2023**, for the Renovate Generals Quarters, (PN466501) project.

There will be an on-site pre-bid meeting on September 7, 2023 at 10:00 AM MT. All bidders may meet at Building 250. This pre-bid meeting is not mandatory for any bidders to submit for the project and is the only opportunity to review the site. All individuals attending the pre-bid meeting must have an active form of identification to access the site.

Copies of the Plans and Specifications may be obtained at the office of TSP Inc., 600 Kansas City Street, Rapid City, SD 57701, 605-343-6102. Anyone requesting, reviewing, or copying Plans and Specifications for this project agrees that they are doing so for the sole purpose of submitting a bid on the project. Bidder further agrees the Plans and Specifications are the sole property of the State.

Each bid in excess of \$100,000.00 must either pre-mail a certified check, cashier's check, or draft in the amount of 5% of the base bid and all add alternates and drawn on a State or National Bank to the SD Dept. of the Military, 2823 W. Main Street, Rapid City, SD 57702, or upload a copy of their 10% bid bond to their electronic bid issued by a surety authorized to do business in the State of South Dakota and made payable to the South Dakota Department of the Military. The SD Dept. of the Military reserves the right to reject any or all bids and to waive any irregularities therein.

Published twice at the total approximate cost of \$89.68.

To Be Advertised In The: Rapid City Journal on September 5, 2023 and September 12, 2023.

cc: Construction Industry Center, <u>cic@constructionindustrycenter.com</u>

BIDDER'S CHECKLIST

The following items need to be submitted along with your bid. All bids and any modifications to bids must be in the hands of the Engineering Manager or the Engineering Manager's representative on or before the time set for opening bids in the Invitation for Bids.

- All blanks on the Bid Form are filled in.
- Receipt of all addenda is noted on the Bid Form.
- Bid Form is signed by an officer of the corporation or, if not a corporation, a proprietor or partner.
- For bids of \$100,000.00 or higher, a bid bond or security is submitted with the bid.
- If a foreign contractor, a fully executed "Non-Resident Bidder Affidavit" is submitted with the bid.
- The bid, bid bond or security, and "Non-Resident Bidder Affidavit" are placed in a sealed envelope labeled in accordance with Paragraph 2 of the "Instructions to Bidders."

ASBESTOS STATEMENT

ASBESTOS CONTAINING MATERIALS CAUTION:

It is brought to the contractor's attention that asbestos containing materials (greater than 1%) may be present outside the project requirements yet within the building or area. The contractor shall take the necessary precautions so as not to disturb this material. If asbestos containing materials are disturbed, the contractor shall follow and comply with the state rules promulgated under SDCL 34-44 pertaining to asbestos, and 29 CFR 1926.58, 40 CFR Part 61, 40 CFR Part 763 as in effect and the United States Environmental Protection Agency publication entitled "Guidance for Controlling Asbestos Containing Materials in Buildings" (EPA 560/5-85-024, June 1985).

ASBESTOS CONTAINING MATERIALS STATEMENT:

In accordance with the provisions of SDCL 34-44-8, all bidders and contractors are hereby notified that to the best knowledge of the owner or those representing him in any capacity, this project <u>does not</u> involve asbestos containing materials (greater than 1%). Bidders are further instructed that no asbestos containing materials are to be installed in this project.

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

ASBESTOS LIABILITY STATEMENT

In accordance with amended SDCL 34-44, neither the owner, employees, or agents of the owner, nor any other person may have any claim, right or action against the prime contractor for any asbestos related injury or damage arising from the activities of a certified asbestos abatement subcontractor. Unless exempt under applicable state and federal law, no asbestos abatement work may be performed except by a certified asbestos contractor. A certified asbestos abatement subcontractor shall hold the owner and general contractor harmless from any liability arising from such subcontractor's activities on the project. A certified asbestos abatement contractor shall cause the owner and, if acting as a subcontractor, the general contractor to be named as additional insureds and provide sufficient proof of insurance for purposes of this section.

INSTRUCTIONS TO BIDDERS

1. Examination of Plans, Specifications and Site.

Bidders should carefully examine the site of the proposed work, subsurface conditions, the Plans and Specifications, and the bid and contract documents governing the project. The submission of bids is conclusive evidence that the bidder has investigated and is satisfied as to the conditions to be encountered; the character, quality, and scope of the proposed work; the quality and quantity of the materials to be furnished; and the requirements of the bid, the Plans and Specifications, and the other Contract Documents.

The Plans and Specifications are to be used only with respect to this project and are not to be used for any other project or purposes other than preparing a bid for this project; the Plans and Specifications will not be disseminated to any person or entity for purposes other than obtaining pricing information without the express written approval of the state; all information contained in the Plans and Specifications is confidential; and should the bidder disseminate the Plans and Specifications to an individual or entity for purposes of obtaining pricing information, the bidder will require that individual or entity to adhere to the terms set forth herein. The bidder, however, assumes no liability for the misuse of the Plans and Specifications by such third party or such third party's failure to comply with the provisions contained herein.

Any copies of the Plans and Specifications obtained directly from the State will be returned to the office of the Architect/Engineer immediately after the State provides notice that bidder will not be awarded a contract, or thirty (30) days after the bid opening for the project, whichever occurs first. Any copies of the Plans and Specifications made by the bidder will be destroyed immediately after the State provides notice that bidder will not be awarded a contract, or thirty (30) days after the bid opening for the project, whichever occurs first. If bidder will not be awarded a contract, or thirty (30) days after the bid opening for the project, whichever occurs first. If bidder does not submit a bid, bidder will fulfill the requirements previously outlined on or before the date of the bid opening. Should bidder be awarded a contract for construction of the project, bidder does not need to return or destroy Plans and Specifications until after completion of the project.

2. Submission of Bids.

Each bid must:

- a. Be submitted on the prescribed form (Exhibit "A"); all blank spaces for bid prices must be filled in, in ink or typewritten, in both words and figures;
- b. Include any addenda issued during the time of advertising for bids the same as though it had been included in the original Plans and Specifications; and
- c. Be submitted in a sealed opaque envelope bearing on the outside the name of the bidder, his/her address, and the name of the project for which the bid is submitted. See Exhibit "B" attached hereto for Sample Format for envelope. If forwarded by mail, Federal Express, or other commercial courier, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified on the bid form.

All bids and any modifications to bids must be in the hands of the Engineering Manager or the Engineering Manager's representative on or before the time set for opening bids in the Invitation for Bids. Bids that are not properly marked may be disregarded. Bids will not be received after the time for bid opening.

3. Modification of Bids.

- a. Bids may be modified by mail or email received at the place designated in the Invitation to Bid, not later than the time set for the opening of bids. A modification shall not reveal the bid price, but shall provide the addition or subtraction or the modification so that the final prices or terms will not be known to the public corporation until the sealed bid is opened (see Exhibit "A-1", Modification To Bid Form). A modification may not be withdrawn after the time set for the opening of bids. No bid made shall be changed or altered by telephone. No oral changes, alterations or conditions will be accepted under any circumstance.
- b. An email modification must be submitted on Exhibit "A-1", Modification To Bid Form to the email address <u>cullen.jorgensen@state.sd.us</u>. Pursuant to the requirements of SDCL §5-18A-5(6), Department of the Military will not accept any email modification received in its offices after the time set for the opening of bids.

4. Contractor's Qualification Statement.

For bids of \$100,000.00 or more, the low bidder, upon request, must submit to the Department of the Military, within 48 hours of said request, Contractor's Statement of Skills and Capabilities (Exhibit "F") with their bids. The Contractor's Qualification Statement (AIA Document A305) or the AGC's Contractor Qualification Statement may

be used provided it includes all the information required by the Department of the Military document, minus the financial statement.

5. Bid Security.

Each bid over \$100,000.00 must be accompanied by a bid security as follows:

- a. <u>Certified Check, Cashier's Check or Draft</u>. A certified check, cashier's check or draft for five percent (5%) of the amount of the bid, including all add alternates, such check to be certified or issued by either a State or National Bank and payable to said public corporation or officer.
- b. <u>Bid Bond</u>. In lieu of a certified check as a bid guarantee, a bid bond of ten percent (10%) of the total amount of the bid, including all add alternates, may be furnished by the Contractor. See Exhibit "C" for Bid Bond form. Such bond to be issued by a surety authorized to do business in the State of South Dakota. Such bond shall be payable to said public corporation or officer as guaranty that such bidder will enter into a contract with said public corporation, its Board or officers thereof, in accordance with the terms of such letting and bid in case such bidder be awarded the contract.

No bidder shall be required to leave his/her certified check or other guaranty or bid bond posted for a longer period than thirty (30) days if the bid is not accepted. The certified check or other guaranty of the successful bidder shall be returned to him forthwith upon the execution of the contract and surety herein provided for.

6. Withdrawal of Bids.

Any bid may be withdrawn by letter, email, or in person before the time specified in the advertisement therefor. Withdrawal of a bid does not prejudice a bidder's right to submit a new bid within the time designated for the submission of bids. No bids may be withdrawn after the time designated in the Invitation to Bid for the opening of bids. The email address for withdrawing a bid is <u>cullen.jorgensen@state.sd.us</u>.

7. Request for Interpretation.

Any person who plans to bid on the project may submit to the Owner a written request for an interpretation of any part of the Plans and Specifications or Contract Documents. Requests for interpretations shall be made not less than ten (10) days prior to the opening of bids. Any interpretation will be in writing and furnished to each person receiving Plans and Specifications for bidding. The Owner will not be responsible for any other explanation or interpretation.

8. Or Equal Clause.

Whenever a material, article, or piece of equipment is identified on the Plans or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and any materials, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the requirements of Article 6.3.4 of the General Conditions are met and the material, article, or equipment so proposed is, in the opinion of the Architect and Engineering Manager, of equal substance and functions.

9. Preference for South Dakota Products, Labor and Materials.

By virtue of statutory authority in SDCL § 5-18A-6(10) et seq. preference will be given to South Dakota products, labor and materials as provided by law.

10. Opening of Bids.

Bids will be received until the time for opening designated in the Invitation to Bid. All bids received within the designated time will be opened and read aloud at the time and place designated in the Invitation to Bid. Bidders and their authorized agents are invited to attend.

11. Relief from Mistake in Bid.

A bidder claiming a mistake in a bid must give the State written notice of the alleged mistake within five calendar days after the bids are opened, specifying in detail how the mistake occurred. Relief will only be granted for clerical or mathematical mistakes which can be documented to the satisfaction of the Engineering Manager.

12. Rejection of Bids.

Bids may be rejected if they show any alteration of form, additions not called for, conditional bids, incomplete bids, unexplained erasures, or irregularities of any kind. The State may waive any informality in the bids received.

When bids are signed by an agent other than an authorized corporate officer or member of a partnership, a power of attorney must be filed with the bid. Otherwise, the bid will be rejected as irregular and unauthorized. If there is reason to believe that collusion among the bidders exists, any or all bids may be rejected. The State reserves the right to reject all bids if in the judgment of the Engineering Manager it is in the best interest of the State.

13. Award of Contract.

If the contract is awarded, it will be awarded to the responsible bidder submitting the lowest bid, subject to paragraph 17 below, which complies with the Invitation to Bid and with these instructions. The successful bidder will be notified within thirty (30) calendar days of the date bids are opened. Subsequent to notice of award, the successful bidder will be presented with a contract agreement. The contract will require the completion of work according to the Plans and Specifications and the Contract Documents. Conditional bids will not be accepted.

14. Responsibility.

The Owner may make such investigations as he/she deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner 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 that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein.

15. Nonresident Bids.

SDCL § 5-18A-26, provides that the Contract shall be let to the lowest responsible bidder; provided, however, a resident bidder may be allowed a preference on any such contract as against the bid of any bidder from any other State or foreign province which enforces or has a preference for resident bidders. The amount of the preference given to the resident bidder shall be equal to the preference in the other state.

16. Subcontractor Certification.

SDCL§ 5-18B-6, provides that prior to execution of a public improvement project a successful bidder shall certify on the prescribed form (Exhibit "G"):

- (1) That no more than twenty-percent of the cost of labor included in the contract is being provided by nonresident subcontractors; or
- (2) That more than twenty percent of the cost of labor included in the contract is being provided by nonresident subcontractors because resident contractors are not available and at competitive prices.

17. Method of Award.

- a. <u>Bidding procedure involving only a base bid:</u> If the base bid is within the amount of funds available to finance the construction contract, then contract award will be made to that responsible bidder submitting the low base bid. If the low bid exceeds the funds available to finance the construction, the State may negotiate with the low bidder to produce a bid amount within the availability of funds.
- b. <u>Bidding procedure involving a base bid and alternate bids:</u> If the base bid is within the amount of funds available to finance the construction contract and the Owner wishes to accept alternate bids, then contract award will be made to that responsible bidder submitting the low combined bid, consisting of the base bid and any combination of add or deduct alternative bids found to be most advantageous to the Owner. Under this procedure, if the Owner wishes to make award on low base bid only, then contract award will be made to that responsible bidder submitting the low bid exceeds the funds available to finance the construction, the State may negotiate with the low bidder to produce a bid amount within the availability of funds.

18. Execution of Agreement.

Within ten (10) calendar days after the proposed contract agreement is presented to the successful bidder for execution, the successful bidder must execute the contract documents and, *if the Contract is for more than* \$100,000.00, provide a performance and labor and material payment bond.

19. Performance & Labor and Material Payment Bond.

If the Contract is for more than \$100,000.00, provide a performance and labor and material payment bond produced by a South Dakota licensed insurance producer (agent) and issued by a South Dakota licensed surety in an amount not less than the amount of the awarded contract. The performance and labor and material payment bond Surety or Sureties shall meet all requirements of South Dakota Law.

This bond is to secure the faithful performance of the contract and the payment of those to whom the bidder may become legally indebted for labor, materials, tools, equipment, or services of any kind used or employed by the bidder in performing the work. The surety bond shall be on the form attached hereto as Exhibit "D". (Failure on the part of the bidder to furnish such bond in the time stated shall be cause for consideration by the State of awarding the Contract to the second low bidder and the retention of the bid deposit.)

20. Power of Attorney.

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

21. Default.

The failure to execute the contract documents or to furnish bonds required by these instructions within ten (10) calendar days after the proposed contract agreement is presented for execution constitutes a default. In the event of a default, the State may award the contract to the next lowest bidder or may re-advertise for bids. The State may charge against the defaulting bidder the difference between the amount of the bid and the amount for which a contract for the work is subsequently executed plus the State's additional administrative cost necessitated by the bidder's failure to execute the Contract Documents, irrespective of whether the amount thus due exceeds the amount of the bid bond. If a more favorable bid is received by re-advertising, the defaulting bidder shall have no claim against the State for a refund.

22. Commencement of Work/Time of Completion.

The contractor for the general construction shall commence work under the contract within ten (10) consecutive calendar days after issuance of written Notice to Proceed and shall substantially complete all work under the contract within the timeframe specified in the Bid Form.

23. Liquidated Damages.

See Article 10.3.4 of the General Conditions.

24. Applicable Laws and Regulations.

The bidder's attention is directed to the fact that all applicable South Dakota laws, 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.

25. South Dakota Tax Information for Public Contracts.

Contractors performing public contracts in South Dakota may become responsible for two types of taxes: the excise tax upon realty improvement contracts and the sales/use tax upon materials.

All contractors must secure a license from the Department of Revenue before engaging in the construction activities in this State. Detailed information on tax requirements may be obtained from the Department of Revenue, Anderson Building, Pierre, South Dakota 57501. Telephone 605.773.3311.

26. Applicable Standards.

In addition to codes, Standards and Regulations referenced for compliance in the various sections of the Specifications, the work shall be in compliance with the following:

ANSI Z53.1 - 1971, and as revised Safety color code for marking physical hazards.

ANSI A13.1 - 1975, and as revised Scheme for the identification of piping systems.

ANSI C2, and as revised National Electrical Safety Code.

27. Affirmative Action Plan.

The State of South Dakota requires that all contractors, vendors, and suppliers, employing fifty or more persons, doing business with any State Agency, Department, or Institution, place on file a statement of Affirmative Action that said contractor, vendor, or supplier does not discriminate in its employment practices with regard to race, color, religion, sex or national origin.

No award of any contract with the State of South Dakota shall be executed or awarded and approved by the State for any service, supply, or commodity unless the successful bidder submits such statement.

Above statement may be submitted to the Engineering Manager with the contractor's bid, or prior to award of contract.

28. Procurement Law.

This project is subject to the provisions of SDCL § 5-18A and 5-18B et seq.

EXHIBIT "A" BID FORM

Renovate General's Quarters – Camp Rapid, B250 CFMO# 466501

To: Engineering Manager Joint Force Headquarters Building 2823 West Main Street Rapid City, South Dakota 57701 Date: August 31, 2023

Phone: 605-737-6637

The undersigned, being familiar with the local conditions affecting the work, and with the Contract Documents, including the Invitation to Bid, Instructions to Bidders, Bid Form, Explanation of Alternates, Modification to Bid Form, Bid Bond Form, Performance and Payment Bond, Acknowledgment of Surety, Sample Certification of Surety, Non-Resident Bidder Affidavit, Form of Agreement for Construction, General Conditions, Special Conditions, Technical Specifications, Plans and Addenda which govern the purchase of material and labor and the awarding of contracts hereby proposes to do all the work and provide all the material and equipment which pertains to <u>**Renovate General's Quarters – Camp Rapid, B250**</u> CFMO# <u>**466501**</u> as provided for in the Plan and accompanying Specifications dated <u>August 2023</u> for the following base bid and alternates:

BASE BID

DOLLARS (\$

The above unit prices shall include all labor, materials, bailing, shoring removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for. Changes shall be processed in accordance with Article 14 of the General Conditions.

The Owner also reserves the unrestricted privilege to reject any unit prices for additions to or deductions from the scheduled amount of work as given in the Bid, if the same are considered excessive or unreasonable, or to accept by including the same in the contract as unit prices applicable in the event of addition to or deduction from the work to be performed under the contract, any or all such unit prices which may be considered fair or reasonable.

The above bid includes all applicable State and Municipal Sales and Use Taxes on materials, and State and Municipal Excise Taxes and all other State and Federal Taxes that would affect the amount of the bid. (See Instructions to Bidders-SD Sales and Use Tax Information for Public Contracts.)

In addition, any material furnished by the State for use in this project is subject to Use Tax and Excise Tax. The total taxable value of materials furnished by the State for this project is \$___0.00_.

A Performance and Payment Bond as required by General Conditions will not be required on contracts which do not exceed One Hundred Thousand Dollars (\$100,000). (See SDCL 5-21-1.1 as amended).

If discrepancies remain at the time of substantial completion, a value will be assigned to each of the discrepancies and two (2) times their estimated value will be retained from payment to the Contractor until completed and accepted. (See SDCL 5-18-13 as amended).

Within ten (10) days after Contractor's receipt of the Agreement for Construction, the Contractor shall submit to the Department of the Military, the executed Agreement for Construction, Performance and Payment Bond, Certificates of Insurance and Affirmative Action Plan (if applicable).

Work shall be commenced within ten (10) consecutive calendar days after written Notice to Proceed by the South Dakota Department of the Military Engineering Manager and shall be substantially completed within <u>210</u> calendar days from the date of the Notice to Proceed.

The undersigned acknowledges receipt of the following addenda to the drawings and/or specifications (give number and date of each): Addenda Nos. _____ dated _____ respectively.

The undersigned acknowledges that they have read and understand the Asbestos-Containing Materials Statement contained in the project manual.

Accompanying this proposal is a certified check, cashier's check or draft in the amount of 5% of the base bid and all add alternates, and drawn on a State or National Bank in the amount of \$______ or a 10% bid bond issued by a surety authorized to do business in the State of South Dakota, in the amount of \$______. (Not applicable if Bid is under \$100,000.)

In submitting this bid, it is understood that the right is reserved by the Owner to reject any and all bids and to waive any irregularities. It is further understood by the Bidder that he may not withdraw his Bid within 30 days after the actual opening thereof.

In submitting this bid, bidder asserts it has reviewed all provisions of the General Conditions including the provision for assessment of liquidated delay damages found in Article 10 of the General Conditions. Bidder agrees that the damages anticipated by the Owner in the event of delay in completion of the project are uncertain in amount and difficult to prove; the amount stipulated in Article III of the Agreement for Construction is a reasonable amount in light of the anticipated loss and injury; and the Owner's actual damages in the event of delay would be impracticable or extremely difficult to fix. Bidder agrees to be bound by the liquidated damages set forth in Article III of the Agreement for Construction. Bidder further agrees that the liquidated amount stipulated in Article III of the Agreement for Construction is not a penalty. For contractors, vendors, suppliers, or subcontractors with five (5) or more employees who enter into a contract with the State of South Dakota that involves the expenditure of one hundred thousand dollars (\$100,000) or more, by submitting a response to this solicitation or agreeing to contract with the State, the bidder or offeror certifies and agrees that the following information is correct:

The bidder or offeror, in preparing its response or offer or in considering proposals submitted from qualified, potential vendors, suppliers, and subcontractors, or in the solicitation, selection, or commercial treatment of any vendor, supplier, or subcontractor, has not refused to transact business activities, has not terminated business activities, and has not taken other similar actions intended to limit its commercial relations, related to the subject matter of the bid or offer, with a person or entity on the basis of Israeli national origin, or residence or incorporation in Israel or its territories, with the specific intent to accomplish a boycott or divestment of Israel in a discriminatory manner. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State to reject the bid or response submitted by the bidder or offeror on this project and terminate any contract awarded based on the bid or response. The successful bidder or offeror further agrees to provide immediate written notice to the contracting executive branch agency if during the term of the contract it no longer complies with this certification and agrees such noncompliance may be grounds for contract termination.

The bidder or offeror, in preparing its response or offer or in considering proposals submitted from qualified, potential vendors, suppliers, and subcontractors, or in the solicitation, selection, or commercial treatment of any vendor, supplier, or subcontractor, is not an entity, regardless of its principal place of business, that is ultimately owned or controlled, directly or indirectly, by a foreign national, a foreign parent entity, or foreign government from China, Iran, North Korea, Russia, Cuba, or Venezuela, as defined by South Dakota Executive Order 2023-02. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State to reject the bid or response submitted by the bidder or offeror on this project and terminate any contract awarded based on the bid or response. The successful bidder or offeror further agrees to provide immediate written notice to the contracting executive branch agency if during the term of the contract it no longer complies with this certification and agrees such noncompliance may be grounds for contract termination.

The undersigned further acknowledges that they have read, understand, and agree to the information stated in the Instructions to Bidders.

BIDDER:				
_		(Type Name of Firm)		
BY:				
		(Signature of Firm's Representative)		
		(Type Name and Title of Firm's Representative)		
TELEPHO	TELEPHONE NO.			
E-MAIL A	DDRESS			
BUSINESS	BUSINESS ADDRESS			
STATE OF INCORPORATION				

EXHIBIT "A-1" MODIFICATION TO BID FORM

Renovate General's Quarters – Camp Rapid, B250 CFMO# 466501

To: Engineering Manager Joint Force Headquarters Building 2823 West Main Street Rapid City, South Dakota 57702 Date: August 31, 2023

Phone: 605-737-6637 Email: <u>cullen.jorgensen@state.sd.us</u>

Please make the following modifications to our bid on the referenced project. This modification is per the Instructions to Bidders Item #3 included in the original bid documents and modifies our sealed bid.

<u>Note To Bidder</u>: Please circle the appropriate ADD/DEDUCT and "X" out the undesired action.

Modification to Base Bid - ADD / DEDUCT to our Base Bid the Sum of

_DOLLARS (\$______)

The undersigned acknowledges receipt of the following addenda to the drawings and/or specifications (give number and date of each): Addenda Nos. ______ dated ______ respectively.

In submitting this modification to bid, it is understood that the right is reserved by the Owner to reject any and all bids and to waive any irregularities. It is further understood by the Bidder that he may not withdraw his Bid within 30 days after the actual opening thereof.

BIDDER:	(Type Name of Firm)	_
<u> </u>	(Signature of Firm's Representative)	_
	(Type Name and Title of Firm's Representative)	
TELEPHONE NO.		
E-MAIL ADDRESS		
BUSINESS ADDRESS		_
		_
STATE OF INCORPOR	RATION	_

EXHIBIT "B" SAMPLE OF SEALED ENVELOPE

Return Addres John Smith, Co Box 1 Anytown, USA	ss ontractor		
		TO:	Engineering Manager SD Dept. of the Military Joint Force Headquarters Building 2823 West Main Street Rapid City, South Dakota 57702
Bid For:	Renovate Ge Rapid City CFMO# 4665	neral's Quar 01	ters – Camp Rapid, B250
To Be Opened	: 2:00	PM MT Sep	otember 21, 2023
Addenda Rece	vived: Nos.		

EXHIBIT "C" BID BOND

KNOW ALL MEN BY T	HESE PRESENTS, t	nat we, the undersigned,	
as Principal, and			
as Surety, are hereby	held and firmly b	ound unto	
as owner for the pen	al sum of		of which, well and truly to be made, we
hereby jointly and se	verally bind ourse	ves, our heirs, executors, admin	istrators, successors and assigns.
Signed, this	day of	, 20	
The condition of the	above obligation i	s such that whereas the Principa	l has submitted to
		a certain Bid, att	ached hereto and hereby made a part hereof to
enter into a contract	in writing for the		

NOW, THEREFORE,

- (a) If said Bid shall be rejected, or in the alternate
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract, attached hereto (properly completed in accordance with said bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid.

Then this obligation shall be void, otherwise the same shall remain in force and effect: it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and 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 extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal	
Surety	

SEAL

By:

EXHIBIT "D" PERFORMANCE AND PAYMENT BOND

Contractors shall utilize the Performance and Payment Bond found on the South Dakota Bureau of Administration, Office of the State Engineer website. <u>https://boa.sd.gov/state-engineer/forms.aspx</u>

Contractors shall follow the Performance and Payment Bond Instructions to complete the Performance and Payment Bond.

EXHIBIT "E" NON-RESIDENT BIDDER AFFIDAVIT

Country of)		
State or Province of)ss)		
Business Name:			
Business Address:			
Affiant's Name and Title:			
Project Name and Location:			
CFMO Project Number:			
	AFFIDAVIT WHEN I	NO PREFERENCE IS G	IVEN
I do hereby affirm that			resides in the country of
in the state	or province of		_and that said country and/or state or
province does not grant a preference to	ວ resident bidders fo	or work on behalf of s	said country, state or province.
Dated:		Signed	
		N PREFERENCE IS GIV	/EN
I do hereby affirm that			resides in the country of
in the state or province of	and that said	country and/or state	or province does grant a preference to
resident bidders for work on behalf of	said country, state, o	or province, the natu	re and extent of such preference being
Dated:		Signed	
Dutcu.		Signeu	
	ACKNOWLED	GEMENT OF AFFIANT	r
Country of)		
Chata an Duravinas of) ss		
)		
On thisday of		, 20	, before me personally appeared
, kr	own to me to be th	e affiant who, being	duly sworn, declares all statements made in
this affidavit to be true and correct to t	he best of his or her	knowledge.	
		Notary Public	
My commission expires the	day of		, 20

EXHIBIT "F" STATE OF SOUTH DAKOTA CONTRACTOR'S STATEMENT OF SKILLS AND CAPABILITIES

Send Completed Form to:		South Dakota Department of the Military Attn: Engineering Manager 2823 West Main Street, Bldg. 420 Rapid City, South Dakota 57702		
Project Name:	Renovate Gener	al's Quarters – Camp Rapid, B250		
Location:	Rapid City			
CFMO #	466501			
CONTRACTOR INFORMATION				
A. Business Structure Submitted By:				

1. Current Business Name and Address.

Business Name:	
Address:	
Phone:	
Fax:	
email:	

- 2. How many years has your company been in business under the name listed above?
- Has your company been in business under any other business name(s)?
 If so, list previous business name(s) and the years your company operated under each name:
- 4. If a corporation, provide the:

Date and State of incorporation: Type of corporation: Names of Officers

- President: Vice-president(s): Secretary: Treasurer:
- 5. If a partnership, provide the:
 - State of Organization: Partnership type: Date of organization: Names of partners:
- 6. If individual, provide:

Date of organization: Name of owner:

- 7. Use this space to describe your company's business structure if it differs from those listed above:
- 8. List the states and trades in which you may legally do business where applicable. Provide registration or license number(s).
- 9. If your company is organized under the laws of another state, has it registered with the Secretary of State for the State of South Dakota and/or the Department of Revenue?

B. Background and History

- 1. What types of Work does your company perform with its own forces?
- 2. Has your company ever failed to complete Work it had contracted to perform? Provide details if the answer is "yes."
- 3. Within the last five years, has any officer or principal of your company been an officer or principal of another company that failed to complete Work that the latter company contracted to perform? Provide details if "yes."
- 4. List any and all judgments, claims, suits at law, or arbitration proceedings pending or outstanding against your company or its officers regarding any construction contracts:
- 5. Within the last five years, has your company filed law suits or requested arbitration regarding any construction contracts?
- 6. On separate paper, provide a list of major construction projects your company is currently working on. For purposes of this document "major construction projects" shall be considered anything of average size or greater for your company. Provide name of owner, location, architect, contract amount, and scheduled completion.
- 7. On separate paper, list the major construction projects your company has completed in the last five years. For purposes of this document "major construction projects" shall be considered anything of average size or greater for your company. Provide name of owner, project, location, architect, contract amount, and scheduled completion.
- 8. On separate paper, list the construction background/experience of the key personnel in your company.
- 9. What is the average annual value of all construction work your company performed within the last five years?

C. References

- 1. List your company's Business/Industry References:
- 2. List your company's Financial References:
- 3. Provide the name and address of your company's Surety, as well as the name and address of the Agent:

SIGNATURE AND NOTARIZATION

Date	Typed Name:			
	Title:			
Signature	Business Name:			
(Affix Seal)				
On this _day of	_, 20, before me personally appeared			
	_, who, being duly sworn, declares all stateme	nts made in this		
Qualification Statement to be true and correct to the	e best of his or her knowledge.			
	Notary Public			
My commission expires the	_day of	, 20		

EXHIBIT "G" **RESIDENT AND NON-RESIDENT** SUBCONTRACTOR BREAKOUT

Company: _____Contract Amount: _____

Date: _____

Project Name: Renovate General's Quarters – Camp Rapid, B250 Re: Project Location: <u>Rapid City</u> CFMO # 466501

Resident Contractors

Company	Location	Labor Cost	% Value of Contract
	Total:		

Non- Resident Contractors

Company	Location	Labor Cost	% Value of Contract
	Total:		

As defined in 5-18A:

(26) "Resident," any person, partnership, association, limited liability company, foreign limited liability company, corporation, or foreign corporation licensed to do business within this state that has maintained a substantial and bona fide place of business and has conducted business from within this state for at least one year prior to the date on which a contract was awarded. The members of the partnership or association shall have been bona fide residents of the state for one year or more immediately prior to bidding upon the contract. A foreign corporation licensed pursuant to §§ 47-1A-1501 to 47-1A-1532, inclusive, is not a resident as defined by this section if the state or country in which it is organized enforces or has a preference for resident bidders;

If more than 20% of the labor cost included in the contract is being provided by nonresident subcontractors, please explain:
EXHIBIT "H" CONTRACTOR'S EXCISE TAX LICENSE

CERTIFICATION

Effective July 1, 2003, no public corporation may award any contract for the construction of any public improvement unless the contractor has a contractors' excise tax license. (SDCL 5-18B-17) In addition, all contractors that contract for construction services or realty improvement work in South Dakota must have a contractor's excise tax license. (SDCL 10-46A and 10-46B)

To be awarded a contract with the State of South Dakota, or to be considered for future contracts, your business must have a South Dakota contractors' excise tax permit. If you do not have a contractor's excise tax permit, you may apply for a permit with the South Dakota Department of Revenue. You may obtain an application from the Department of Revenue's web-site at <u>www.state.sd.us/drr</u> or by calling 1-800-TAX-9188.

Please complete the following and return this form to this office with your bid/contract. This information will be verified with the Department of Revenue.

1.	Owner Name:	
2.	Business Name:	
	-	

3. South Dakota Contractor's Excise Tax Permit Number: _____

4. If you applied for a contractors' excise tax license but have not received the license yet, please list your federal identification number and the date you applied for a license:

Federal ID # _____ Application Date: _____

Failure to provide documentation that your business is licensed will result in your removal from contracts with the State of South Dakota.

I certify that, to the best of my knowledge, the above information is accurate and complete.

Signature

Date

,20

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STATE OF SOUTH DAKOTA AGREEMENT FOR CONSTRUCTION

PRIME CONTRACT FOR

RENOVATE GENERAL'S QUARTERS BUILDING 250 – RC CAMP RAPID

Rapid City, South Dakota

CFMO# 466501

THIS Agreement is made the **xxth day of Month**, **20xx** by and between **Name of Contractor** (the "Contractor") and the **South Dakota Department of the Military** represented by its legal officers (the "Owner").

WITNESSETH, that the Contractor and the Owner for the consideration stated herein agree as follows:

ARTICLE I – CONTRACT DOCUMENTS:

The following documents and any other documents incorporated in them by reference constitute the contract documents:

- 1. This Agreement
- 2. The Project Manual dated August 2023
- 3. The Project Drawings dated August 2023
- 4. Addenda issued prior to execution of this Agreement dated Month Year, Month Year, and Month Year.
- 5. Contractor's Performance and Labor and Material Payment Bond
- 6. Value Engineering Letter dated Month Year

These documents constitute the entire and integrated agreement between the parties hereto and supersede prior negotiations, representations, or agreements, either written or oral. The Index for items 2 and 3 is attached hereto as Exhibit "A."

ARTICLE II – STATEMENT OF WORK:

To the extent not otherwise provided in the contract documents, contractor shall furnish and pay for all labor, tools, equipment, supplies, materials, appurtenances, utilities, charges, fees, permits, and all other construction accessories and services required to complete the work specified in the contract documents in strict compliance with the contract documents.

A background check will be completed on all superintendents by the SDARNG. The project superintendents will need to be on site AT ALL TIMES that work is being completed as an escort to those without background checks. Any additional background checks required will be done at the contractor's expense. When necessary, a contractors badge will be issued to the prime contractor superintendent. This badge must be turned in to the Project Manager upon successful completion of the project.

Upon successful completion of the project, the contractor must provide, in addition to the operation and maintenance manuals, a digital copy of all of the warranties listed in Microsoft Excel format. The tables should include at a minimum: the item with a warranty, the length of the warranty, and contact information of who services the warranty.

ARTICLE III – DATE OF COMMENCEMENT AND COMPLETION:

- A. The work shall be commenced within ten (10) consecutive calendar days after the date of issuance of the Notice to Proceed by the Owner.
- B. The project shall be substantially completed not later than **210 calendar days from the effective date of the Notice to Proceed,** subject to adjustments of the contract time as provided in the contract documents.
- C. Should the Contractor fail to substantially complete the work within the time set forth herein, or within such extra time as may have been allowed by increases in the contract, or by formally approved extensions granted by the Owner, the Contractor and the Contractor's surety shall be liable for and shall pay the Owner **\$800.00 per calendar day as** liquidated damages for each calendar day of delay until the work is substantially complete.
- D. The project shall be completed and ready for final inspection/acceptance no later than **224 calendar days from the effective date of the Notice to Proceed,** subject to adjustments of the contract time as provided in the contract documents.

E. After Substantial Completion, if the Contractor shall neglect, refuse, or fail to complete the remaining Work as outlined in the approved punch list, subject to adjustments of the contract time as provided in the contract documents, the Contractor shall be liable for and shall pay the Owner **\$800.00 per calendar day as liquidated damages** for each calendar day of delay until the Work is completed and ready for final inspection/acceptance.

ARTICLE IV – CONTRACT SUM:

- A. For the performance of the work specified in the Contract Documents, Owner will pay Contractor and Contractor will accept as full compensation the sum of **\$(AMOUNT)**, subject to additions or deductions as provided in the contract documents;
- B. Contract sum includes the following alternates, if any, which are described in the Contract Documents and are hereby, accepted by the Owner: N/A or List Alternates by Number, Name and Price
- C. Unit Prices, if any, are as follows: Where the quantities originally contemplated are so changed that application of the agreed unit price to the quantity of work performed is shown to create a hardship to the Owner or the Contractor, there shall be an equitable adjustment of the contract to prevent such hardship.
- D. Contract sum includes the following value engineering items, if any, which are described in the Contract Documents and are hereby, accepted by the Owner: N/A or List Value Engineered Items by Number, Description and Mod. Price

ARTICLE V – PROGRESS PAYMENTS:

The Owner shall make progress payments on a monthly basis for work accomplished in accordance with General Conditions, Article 11.

ARTICLE VI - ACCEPTANCE AND FINAL PAYMENT:

- A. Final payment less amounts withheld to cover the cost of nonconforming work, shall be made by the Owner in accordance with General Conditions Sub-Article 11.8.
- B. Prior to issuing final payment, the Contractor shall provide all submittals required within the project manual, specifically those listed in specification section 00 65 00 Closeout Forms.

ARTICLE VII – NOTICE:

All notices, demands and other communications required by the Contract Documents shall be in writing and shall be deemed to have been duly given if personally delivered, mailed first class (postage prepaid), or e-mailed:

1) If to Contractor:

FIRM NAME Attn: NAME, TITLE ADDRESS LINE 1 ADDRESS LINE 2 Phone: ###.###.#### Email: EMAIL ADDRESS

2) If to the State:

Department of the Military Attn: Kelly Eitreim 2823 West Main St., Bldg 420 Rapid City, South Dakota 57702-8170 Phone: 605.737.6637 Email: kelly.eitreim@state.sd.us

3) If to the Architect:

TSP, Inc. Attn: Chris Maks 600 Kansas City Street Rapid City, SD 57701 Phone: 605.343.6102 Email: <u>maksch@teamtsp.com</u> Either party may change the addresses set forth for notice herein upon written notice thereof to the other.

ARTICLE VIII – CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSION:

- A. Contractor certifies, by signing this Agreement, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation, by any Federal department or agency, from transactions involving the use of Federal funds.
- B. Pursuant Executive Order 2020-01, for contractors, vendors, suppliers, or subcontractors with five (5) or more employees who enter into a contract with the State of South Dakota that involves the expenditure of one hundred thousand dollars (\$100,000) or more, by signing this contract the Contractor certifies and agrees that it has not refused to transact business activities, have not terminated business activities, and have not taken other similar actions intended to limit its commercial relations, related to the subject matter of the contract, with a person or entity that is either the State of Israel, or a company doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel to do business, or doing business in the State of Israel, with the specific intent to accomplish a boycott or divestment of Israel in a discriminatory manner. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State if during the term of the contract. The Contractor further agrees to provide immediate written notice to the State if during the term of the contract it no longer complies with this certification, and agrees such noncompliance may be grounds for contract termination."

C. COMPLIANCE WITH EXECUTIVE ORDER 2023-02:

Contractor certifies and agrees that the following information is correct:

In preparing its response or offer or in considering proposals submitted from qualified, potential subconsultants, vendors, suppliers, and subcontractors, or in the solicitation, selection, or commercial treatment of any subconsultant, vendor, supplier, or subcontractor, Contractor is not an entity, regardless of its principal place of business, that is ultimately owned or controlled, directly or indirectly, by a foreign national, a foreign parent entity, or foreign government from China, Iran, North Korea, Russia, Cuba, or Venezuela, as defined by South Dakota Executive Order 2023-02.

Contractor further agrees that, if this certification is false, such false certification will constitute grounds for the State to terminate this Agreement. Contractor further agrees to provide immediate written notice to the State if during the term of this Agreement it no longer complies with this certification and agrees such noncompliance may be grounds for termination of this Agreement.

IN WITNESS WHEREOF, THE parties hereto have caused this instrument to be executed in one original counterpart the day and year above first written:

CONTRACTOR:				
	CONTRACTOR NAME:	(Affix Cor	norata Saal if Availabla	
			porate sear in Available)	
	SIGNATURE:			
	PRINTED NAME:			
	TITLE:			
	DATE:			
RECOMMENDE	D BY		STATE OF SOUTH DAKOTA	
DEPARTMENT (OF THE MILITARY		DEPARTMENT OF THE MILITARY	
CULLEN B. JORG	GENSEN	(Date)	MARK R. MORRELL, Maj Gen (SD), SDNG	(Date)
Engineering Ma	anager		The Adjutant General	

Exhibit "A" AGREEMENT FOR CONSTRUCTION Enumeration of Contract Documents

1. This agreement

- 2. The General and Special Conditions contained in the Project Manual dated August 2023
- 3. The Invitation for Bids and Instruction to Bidders contained in the Project Manual dated August 2023
- 4. The Specifications are those contained in the Project Manual dated **August 2023** and are as follows:

Section	<u>Title</u>
00 00 01	Index
00 00 02	Invitation to Bid
00 00 03	Bidder's Checklist
00 00 04	Asbestos Statement
00 00 05	Instruction to Bidders
00 00 05A	Bid Form
00 00 05-A1	Modification to Bid Form
00 00 05-B	Format for Sealed Envelope
00 00 05-C	Bid Bond
00 00 05-D	Performance and Payment Bond
00 00 05-E	Non-Resident Bidder Affidavit
00 00 05-F	Contractor's Statement of Skills and Capabilities
00 00 05-G	Subcontractor Certification
00 00 05-H	Excise Tax License
00 00 06	Agreement for Construction
00 00 07	General Conditions
00 01 00	Technical Specifications Index
00 01 15	List of Drawings Sheets

5. The drawings are as follows:

<u>Number</u>	<u>Title</u>
G-001	Cover Sheet
G-101	Life Safety Plan
C-101	Site and Utility Plan
C-102	Grading Plan
C-103	Site Profiles
C-104	Erosion Control Plan
C-105	Site Details
S-001	Structural General Notes & Title Sheet
S-101	Existing Foundation, Floor Framing & Roof Framing Plans
S-102	New Foundation Plan
S-103	New Floor Framing Plan
S-104	New Roof Framing Plan
S-501	Structural Details
AD101	Demolition Floor Plans
AD102	Reflected Ceiling Demolition Plans
AP101	First Level Floor Plan
AP102	Lower Level Floor Plan
AC101	First Level Reflected Ceiling Plan
AC102	Lower Level Reflected Ceiling Plan
AF101	Finish Floor Plan and Schedules
A-301	Stair and Deck Details
A-401	Interior Elevations

A-402	Interior Elevations
M-001	Mechanical Title Sheet
FP101	Fire Protection Plans
PD101	Plumbing Demolition Plans
PL101	Plumbing Plans – New Construction
MD101	Mechanical Demolition Plan
MH101	Mechanical HVAC Plan – New Construction
M-401	Enlarged Mechanical Plans
M-501	Mechanical Details
ME601	Mechanical Schedules
E-001	Electrical Symbols, Abbreviations, and General Notes
ED101	Electrical Demolition Plan
EL101	Lighting Plans
EP101	Power and Technology Plans
E-601	Electrical Riser and Schedules

6. The addenda, if any, are as follows:

<u>Number</u>	Date
---------------	------

7. Value Engineering Letter dated: Date or N/A

8.	The Performance and Labor and Material Payment Bond dated			
	Issued by	Bond #	·	

9. Other documents forming a part of the Contract Documents are: None

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GENERAL CONDITIONS TO AGREEMENT FOR CONSTRUCTION

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Article 1 Definitions

- 1.1 **Owner:** The owner is the State of South Dakota acting through the legally appointed commissioner for the Bureau of Administration and his representative, the Office of the State Engineer.
- 1.2 **Architect/Engineer:** The term "architect/engineer" (hereinafter A/E) means the person or entity identified as such on the cover sheet to the drawings or plans and his/her authorized representative including his/her consulting engineer(s).
- 1.3 **Contractor:** The term "contractor" means the person or entity identified as such in the Agreement for Construction and his authorized representatives.
- 1.4 **Subcontractor:** Any individual, firm or corporation to whom the Contractor sublets any part of the contract for supplying materials and labor, or only labor, at the site of the project.
- 1.5 **The Contract Documents:** The documents identified as the Contract Documents in the Agreement for Construction.
- **1.6 The Contract:** The Contract Documents form the contract. The contract may be amended or modified only in writing in the manner set forth in Article 14. Nothing contained in the Contract Documents shall create any contractual relationship between the owner and any subcontractor, sub-subcontractor or supplier.
- 1.7 **The Work:** The completed construction required by the Contract Documents, and every part thereof, and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated into such construction.
- **1.8 The Project:** The total construction of which the work performed under the Contract Documents may be the whole or a part.
- 1.9 **The Drawings or Plans:** The graphic and pictorial portions of the Contract Documents showing the design, dimensions and layout of the work including, but not limited to, plan views, elevation views, details, sections, schedules, and diagrams.
- 1.10 **The Specifications:** The written requirements in the Contract Documents for materials, equipment, construction systems, standards and workmanship.
- 1.11 **The Project Manual:** The manual compiled for the work containing the Invitation for Bid, Instructions to Bidders, blank form of Bid Bond, blank form of Agreement for Construction, blank form of Performance and Labor and Material Payment Bond, sample forms, General Conditions, and Special Conditions.

Article 2 Execution, Correlation and Intent

- 2.1 By executing the contract, the contractor represents he has examined the plans, specifications, site of the proposed Work and Contract Documents in accordance with the requirements of the Instructions to Bidders.
- 2.2 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. Work not covered in the Contract Documents will not be required unless it is consistent therewith and is reasonably inferable therefrom as being necessary to produce the intended results. Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings. All work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such work is to be done by others. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written change.

- 2.3 The organization of the Specifications into Divisions, Sections and Articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of work to be performed by any trade.
- 2.4 Neither the Owner nor the A/E assumes any liability arising out of jurisdictional issues raised or claims advanced by trade organizations or other interested parties based on the arrangement or manner of subdivision of the content of the Specifications and Drawings.
- 2.5 The Contractor and all Subcontractors shall refer to all of the Drawings, including those showing primarily the work of the mechanical, electrical, and other specialized trades, and to all of the Sections of the Specifications, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results. The Contractor shall promptly report any discrepancy or omission which it observes in the Construction Documents and any need for clarification or interpretation to the Owner and the A/E. The Contractor's failure to do so will cause any additional cost incurred by the Contractor to be its sole responsibility. The Contractor shall number Requests for Information in consecutive order. The Contractor shall maintain a log of each Request for Information indicating the date it was issued, the date or dates of any correspondence and/or discussions on the Request for Information, and the date a final answer is received.
- 2.6 The General Conditions and the Special Conditions are a part of each Section of the Specifications. The Special Conditions for Mechanical and Electrical Trades, if any, are part of each Section of the Specifications referenced therein, and apply to the work of the trades affected thereby.
- 2.7 A typical or representative detail indicated on the Drawings shall constitute the standard for workmanship and material throughout corresponding parts of the Work. Where necessary, and where reasonably inferable from the Construction Documents, the Contractor shall adapt such representative detail for application to such corresponding parts of the Work. The details of such adaptation shall be subject to prior approval by the A/E. Repetitive features shown in outline on the drawings shall be in exact accordance with corresponding features completely shown.
- 2.8 The layout of mechanical and electrical systems, equipment, fixtures, piping, ductwork, conduit, specialty items, and accessories indicated on the Drawings is diagrammatic, and all variations in alignment, elevation, and detail required to avoid interferences and satisfy architectural and structural limitations are not necessarily shown. Actual layout of the Work shall be carried out without affecting the architectural, engineering and structural integrity and limitations of the Work and shall be performed in such sequence and manner as to avoid conflicts, provide clear access to all control points, including valves, strainers, control devices, and specialty items of every nature related to such systems and equipment, obtain maximum headroom, and provide adequate clearances as required for operation and maintenance.
- 2.9 The Drawings shall not be scaled for dimensions. If figured dimensions are not given on the Drawings, the Contractor shall request same from the A/E giving reasonable advance notice.
- 2.10 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.
- 2.11 Where codes, standards, requirements and publications or public and private trade associations or other bodies are referred to in the Specifications, references shall be understood to be in the latest revision prior to the date of receiving bids, except where otherwise indicated.
- 2.12 Where no explicit quality or standards for materials or workmanship are established for work, such work is to be of good quality for the intended use and consistent with the quality of the surrounding work, of the construction of the Project generally, and industry standards.
- 2.13 All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents. A copy of the manufacturer's written or printed directions shall be provided to the Owner upon completion of the project.

Article 3

Ownership, Use of Documents, Confidentiality of Documents.

3.1 **Ownership of Work Product**

Any plans, specifications, engineering calculations, technical data, reports, miscellaneous drawings, and all information contained therein provided by the State, its consultants, employees, contractors and agents to the contractor for the contractor's performance of its obligations under this agreement are the property of the State. They are to be used only with respect to this Project and are not to be used for any other project. The contractor may not disseminate these materials to any person or entity nor may the contractor use these materials for purposes other than work for the state, without the express written approval of the state. The state shall not unreasonably withhold such approval for dissemination of these materials as necessary to subcontractors and suppliers.

3.2 **Confidentiality of Documents**

All reports, plans, specifications, engineering calculations, technical data, miscellaneous drawings, and information contained therein provided to or prepared by the contractor, its owners, officers, employees, agents, consultants, suppliers, and subcontractors in connection with the contractor's performance under this Agreement are confidential and the contractor, its owners, officers, employees, agents, consultants, suppliers, and subcontractors shall not disclose this information to any person, individual, or entity without the express written permission of the state.

3.3 Return of Documents

All documents covered by Article 3 shall be delivered to the A/E at the completion of the work. The contractor may not retain any such documents for its own use without the express written permission of the state and any documents that are retained, with or without state permission, shall be subject to all of the requirements of Article 3.

3.4 Terms to be Included in Subcontracts

The contractor shall include the requirements of Article 3 in any contract it enters into with any consultants, subcontractors, suppliers, persons, individuals, or entities for the performance of any of the contractor's obligations under this agreement.

Article 4 A/E'S RESPONSIBILITIES

- 4.1 The A/E, under the direction of the State Engineer, will provide administration of the Contract as hereinafter described. The A/E will represent the Owner during construction. The A/E will advise and consult with the Owner. The Owner's instructions to the Contractor may be forwarded through the A/E. The A/E will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with Sub-Article 4.15.
- 4.2 The Contractor shall accept instructions only from the A/E or State Engineer, and not the A/E's consulting engineers, except as the A/E and State Engineer shall authorize in writing.
- 4.3 The A/E will visit the construction site at intervals appropriate to the stage of construction to keep generally familiar with the progress and quality of the work completed and to determine in general if the Project is being constructed in a manner such that when completed it would be in conformance with the plans and specifications and other Contract Documents. The A/E will not, however, be required to make exhaustive or continuous on-site inspections to check the quality or quantity of work. On the basis of such observations or inspections, the A/E shall keep the Owner informed of the progress and quality of the work on the Project and endeavor to guard the Owner against defects and deficiencies in the work of the Contractor. The A/E will maintain written reports of all site visits.
- 4.4 The A/E shall not have control over or charge of and shall not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Project, since these are solely the Contractor's responsibilities under the Agreement for Construction. The A/E shall not be responsible for the Contractor's schedules or failure to carry out the Project in accordance with the Contract Documents. The A/E shall not have control over or charge of acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Project, except to the extent that the A/E may formally notify the Contractor of the unacceptability of various portions of the Project or failure to carry out the Work on the Project in accordance with the Contract Documents.

- 4.5 The A/E will inform the Contractor on behalf of and in consultation with the Owner to cease work on the Project or portions thereof affected by those items that are unacceptable and remain uncorrected until such time as corrections are made.
- 4.6 The A/E shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the A/E may perform his functions under the Contract Documents.
- 4.7 Except as may otherwise be provided in the Contract Documents or when direct communications have been approved by the A/E, the Owner and its representatives and the Contractor shall communicate through the A/E. Communications by and with the A/E's consultants shall be through the A/E.
- 4.8 The A/E will determine the amounts owing to the Contractor based on inspections and observations at the site, and on evaluations of the Contractor's Monthly Applications for Payment, and shall issue Certificates of Payment for amounts due on forms provided by the State Engineer. A Certificate of Payment constitutes a representation by the A/E to the Owner, based upon the inspections and the information provided by the Contractor in the Application, that the Project has progressed to the point indicated; that to the best of the A/E's knowledge, information and belief, the quality of the work on the Project is in accordance with the Contract Documents; and that the Contractor is entitled to payment in the amount certified.
- 4.9 The A/E shall have authority to reject work on the Project which does not conform to the Contract Documents. Whenever the A/E considers it necessary or advisable for implementation of the intent of the Contract Documents, the A/E will have authority to recommend to the Owner additional inspection or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such work is fabricated, installed or completed. However, neither this authority of the A/E nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the A/E to any Construction Contractor, Subcontractors, material and equipment suppliers, their agents or employees or other persons performing portions of the work on the Project.
- 4.10 The A/E shall review and approve or take other appropriate action on Shop Drawings, Product Data and Samples submitted by Construction Contractors to determine if they conform with the design concept for the Project and with the information provided in the Contract Documents, and submit these documents or information to the Owner indicating the A/E's approval or comments with reasonable promptness so as to cause no delay to the prosecution of the Project.

Approval or acceptance of a specific item shall not necessarily indicate the A/E's approval of an assembly of which the item is a component. When professional certification of equipment is required by the Contract Documents, the A/E will be entitled to rely upon that certification to determine that the materials, systems, or equipment will meet the performance criteria required in the Contract Documents.

- 4.11 The A/E will conduct, at the time and place approved by the Owner, with representatives of the State agencies involved in the Project and the Contractor, inspections to establish dates of Project acceptance and completion. The A/E shall have other A/Es, Structural, Mechanical, or Electrical Engineers, or other consultants in their employ in attendance at this and at various progress inspections as may be necessary to evaluate whether the work completed on the Project is in conformance with the Contract Documents. The A/E will receive and forward to the Owner, with comments on completeness or acceptability, those warranties, operation manuals, and other documents required by the Contract Documents and assembled by the Contractor.
- 4.12 The A/E will review the final estimate for final payment to the Contractor and provide a Certificate of Final Payment to the Owner.
- 4.13 The A/E will provide to the Owner or the Contractor, upon written request in the form of a Request for Information, interpretations and decisions in writing, or in the form of drawings, on matters concerning performance under the Contract Documents, and execution or performance of the Work on the Project. Response to such requests shall be made with reasonable promptness and within any time limits agreed upon. The final decision on all such questions shall be made by the State Engineer.

- 4.14 The A/E will prepare Change Orders in accordance with Article 14, and will have authority to order minor changes in the Work as provided in Sub-Article 14.6.
- 4.15 The duties, responsibilities and limitations of authority of the A/E as the Owner's representative during construction as set forth in the Contract Documents will not be modified or extended without written consent of the Owner, the Contractor and the A/E.
- 4.16 In case of the termination of the employment of the A/E, the Owner shall appoint a replacement A/E whose status under the Contract Documents shall be that of the former A/E.

Article 5 OWNER'S RIGHTS AND RESPONSIBILITIES

- 5.1 Information and Services Required of the Owner.
 - 5.1.1 The Owner shall furnish a survey describing the legal limitations and utility locations for the site of the project.
 - 5.1.2 The Owner shall secure and pay for necessary easements, and other property rights required for the construction of the Project.
 - 5.1.3 Information under the Owner's control shall be furnished by the Owner with reasonable promptness after receipt from the Contractor of a written request for such information.
 - 5.1.4 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, 2 sets of paper prints of Drawings and 3 sets of Specifications necessary for the execution of the Work.
 - 5.1.5 The Owner may forward instructions to the Contractor through the A/E or give instructions through the State Engineer.
 - 5.1.6 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Work by the Owner or by separate contractors, Payments and Completion, and insurance in Articles 8, 10, 11 and 13.
- 5.2 Owner's Right to Stop the Work: If the Contractor fails to correct defective Work as required by Article 15 or fails to carry out the Work in accordance with the Contract Documents in any material respect, the Owner, in addition to its other remedies, by a written order signed by the State Engineer or by the State Engineer's designated representative may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.
- 5.3 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 in any material respect and fails within three working days after receipt of written notice from the Owner or in such time as may be established in written notice from Owner to commence and continue correction of such default or neglect with diligence and promptness, or if the Work is not being performed properly or in accordance with the scheduling provisions of the Contract Documents in any material respect, whether or not the Contractor is in default, the Owner may, after the expiration of such notice period and without prejudice to any other remedy he may have, make good such deficiencies. In such case an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the A/E's and State Engineer's additional services made necessary by such default, neglect or failure. If the payments then or thereafter due the contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner upon demand. If, in the sole judgment of the Owner, an emergency exists as a result of the Contractor's default, neglect or failure to correct defective work, which in the Owner's opinion, requires more immediate corrective action than the Contractor is able to provide, then the Owner may, without notice to the Contractor, perform such corrective work or cause it to be performed by others. The Owner shall also have the right to carry out the Work, or any part thereof, during the period of any work stoppage without terminating the Contract. If the Owner wishes to exercise this right it will give the Contractor three days notice of its intent to do so. In any such case, an appropriate deductive Change Order shall be issued in accordance with Article 14,

the amount of which shall not exceed an amount which equals the estimated direct cost, including the State Engineer's fees, of performing the work which the Owner elects to perform and the proportionate amount of the Contractor's fee associated therewith.

5.4 Owner's Right to Access for Observation or Other Work: The Owner reserves the right of access to any part of the Work, at any time, for the purpose of observation, or testing, or to install other work, either with its own forces or with separate contractors. Such access is not to be construed to mean partial occupancy by Owner, and no claim for additional compensation by the Contractor because of such access or installation of work will be considered. Contractor shall cooperate with Owner during Owner's access or performance of work.

ARTICLE 6 CONTRACTOR'S RESPONSIBILITIES

- 6.1 Review of Contract Documents: The Contractor shall carefully study and compare the Contract Documents and shall at once report to the Owner and the A/E any error, inconsistency or omission he may discover. The Contractor shall not be liable to the Owner or the A/E for any damage resulting from any such errors, inconsistency or omission he may discover and report, nor for any damage resulting from any such errors, inconsistencies or omissions which he could not reasonably have discovered. The Contractor shall perform no portion of the work at any time without Construction Documents or, where required, Shop Drawings, Product Data or Samples for such portions of the Work bearing the A/E's appropriate action stamp.
- 6.2 Supervision and Construction Procedures.
 - 6.2.1 The Contractor shall supervise and direct the Work, using the skill and attention necessary to complete the Work in a workmanlike manner. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the contract. Neither the Owner nor the A/E shall have control over, or responsibility for, any such matters.
 - 6.2.2 Nothing contained in the Contract Documents shall be interpreted by implication or otherwise as a direction by the A/E or the Owner to the Contractor as to construction means, methods, techniques, sequences and procedures. If there is express reference to such means, methods, techniques, sequences and procedures, it is solely for the purpose of insuring that the Work will be produced in accordance with the desired objectives as set forth in the Construction Documents but such express reference shall in no way relieve the Contractor of his responsibilities in connection therewith. If the Contractor does not wish to accept the responsibility for any means, techniques, sequences or procedures which are expressly set forth in the Construction Documents, then the contractor shall notify the A/E in writing of the actual means, methods, techniques, sequences and procedures which he will employ on the Work if these differ from those expressly referred to in the Construction Documents. All loss, damage or liability or cost of correcting defective Work arising from the employment of any construction means, methods, techniques, sequences and procedures not withstanding that any of the same shall have been referred to expressly in the Construction Documents.
 - 6.2.3 The Contractor shall be responsible to the Owner for the acts and omissions of his employees, Subcontractors, Sub-subcontractors, materialmen and suppliers and their agents and employees, and other persons performing any of the Work.
 - 6.2.4 The Contractor shall not be relieved from his obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the A/E in his administration of the Contract, by the use or occupancy of part of the Work by the Owner as provided in Sub-Article 5.4, by the performance of work related to the Project by others as provided in Sub-Article 8.1, or by inspections, tests or approvals required or performed under Sub-Article 9.7 by persons other than the Contractor.
 - 6.2.5 The Contractor shall retain a competent Registered Professional Engineer or Registered Land Surveyor, acceptable to the Owner and A/E, who shall establish the exterior lines and required elevations of all buildings and structures to be erected on the site and shall establish sufficient lines and grades for the construction of associated work such as, but not limited to, roads, utilities and site grading. The Engineer or Land Surveyor shall certify as to the actual location of the constructed facilities in relation to property lines, building lines, easements, and other restrictive boundaries.

- 6.2.6 The Contractor shall establish the building grades, lines, levels, column, wall and partition lines required by the various Subcontractors in laying out their work.
- 6.2.7 The Contractor shall coordinate and supervise the work performed by Subcontractors to the end that the work is carried out without conflict between trades or jurisdictional disputes and so that no Subcontractor, at any time, causes delay to the general progress of the Work. The Contractor and all Subcontractors shall at all times afford each other Subcontractor, any separate contractor, and the Owner, every reasonable opportunity for the installation of work and the storage of materials, and shall provide access to and the use of necessary loading dock and hoist facilities, adequate storage room and necessary utilities and other services.
- 6.2.8 Wherever the work of a Subcontractor is dependent upon the work of other Subcontractors, or the Contractor, the Contractor shall require the Subcontractor to:
 - 6.2.8.1 Coordinate his work with the dependent work;
 - 6.2.8.2 Provide necessary dependent data and requirements;
 - 6.2.8.3 Supply and/or install items to be built into dependent work of others;
 - 6.2.8.4 Make provisions for dependent work of others;
 - 6.2.8.5 Examine dependent drawings and specifications;
 - 6.2.8.6 Examine previously placed dependent work;
 - 6.2.8.7 Check and verify dependent dimensions of previously placed work;
 - 6.2.8.8 Notify Contractor of previously placed dependent work or dependent dimensions which are unsatisfactory or will prevent a satisfactory installation of his work; and
 - 6.2.8.9 Not proceed with his work until the unsatisfactory dependent conditions have been corrected.

Installation of Work by a Subcontractor in any given area shall constitute acceptance by the Subcontractor and Contractor of the previously placed dependent work.

- 6.3 Labor and Materials.
 - 6.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The word "provide" shall mean furnish and install complete, including connections, unless otherwise specified. All connection charges, assessments or inspection fees which may be imposed by any public agency or utility company are included in the Contract Sum and shall be the Contractor's responsibility, except the final water and sewer connection charges which shall be paid by the Owner.
 - 6.3.2 The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him. The Contractor shall be responsible to maintain and observe, and to require his Subcontractors to maintain and observe, sound labor practices, and shall require each Subcontractor to take all steps reasonably necessary to avoid labor disputes or stoppages.
 - 6.3.3 Except in the event of emergency, no substantial field operations shall be performed outside of regular working hours without the prior notification of the A/E and the Owner. The Contractor will not be entitled to additional compensation for work performed outside of regular working hours except as otherwise expressly agreed in writing by the Owner prior to the performance of such overtime work. Additional compensation for such authorized overtime shall be limited to the direct cost of the premium portion only of such authorized overtime. No additional indirect cost or fee shall be included.
 - 6.3.4 Substitutions
 - 6.3.4.1 The products, materials and equipment of manufacturers referred to in the Specifications and on the Drawings are intended to establish the standard of quality and design required by the A/E; however, products, materials and equipment manufacturers, other than those specified, may be used, if equivalent and approved in writing by the A/E.

- 6.3.4.2 It is deemed that the term 'or approved equal' is included after all products, materials and equipment referred to in the Specifications or on the Drawings.
- 6.3.4.3 The Owner in consultation with the A/E will be the sole judge of equivalency of proposed substitute products, materials, and equipment. The A/E will make written recommendation of acceptance or rejection to the Owner. The Owner will then authorize the A/E to issue to the Contractor written approval or rejection of the substitution.
- 6.3.4.4 If the Contractor desires to use a substitute item, he shall make application to the A/E in writing in sufficient time (having regard to the progress of the Work, the period of delivery of the goods concerned and adequate time for the Owner's and A/E's review) stating and fully identifying the proposed substitute, cost changes (if any), and submitting substantiating data, sample, brochures, etc. of item proposed. It is the Contractor's responsibility to provide sufficient evidence by tests or other means to support any request for approval of substitution.
- 6.3.4.5 Prior to proposing any substitute item, the Contractor shall satisfy himself that the item he proposes is, in fact, equal to that specified, that it will fit into the space allocated, that it affords comparable ease of operation, maintenance and service, that its appearance, longevity and suitability for the climate and use are comparable to that specified, and that the substitution is in the Owner's best interest.
- 6.3.4.6 The burden of proof that a proposed substitution is equal to a specified item shall be upon the Contractor, who shall support his request with sufficient test data and other means to permit the State Engineer and A/E to make a fair and equitable decision on the merits of the proposal. Any item by a manufacturer other than those cited in the Contract Documents, or of brand name or model number or of generic species other than those cited in the Contract Documents will be considered a substitution.
- 6.3.4.7 Materials and methods proposed as substitutions for specified items shall be supported by certification of their acceptance for use by an authority, person or persons having jurisdiction over the use of the specified material or method.
- 6.3.4.8 Acceptance of substitutions shall not relieve the Contractor from responsibility for compliance with all the requirements of the Construction Documents. The Contractor shall be responsible at his own expense for any changes in other parts of the work of his Contract or the work of other contractors caused by his substitutions, including cost of all design and redesign services related thereto incurred by the A/E and his consultants.
- 6.3.4.9 The Contract completion time shall not be extended by any circumstances resulting from a proposed substitution, nor shall the Contractor be entitled to any compensation for any delay caused thereby or related thereto.
- 6.3.4.10 All costs for the evaluation of proposed substitutions, whether approved or not, shall be borne by the Contractor.
- 6.3.5 All materials and equipment shall be delivered, handled, stored, installed and protected to prevent damage in accordance with best current practice in the industry, in accordance with manufacturers' specifications and recommendations, and in accordance with Contract Document requirements. The Contractor will store packaged materials and equipment in their original and sealed containers, marked with the brand and manufacturer's name, until ready for use, and deliver materials and equipment in ample time to facilitate inspections and tests prior to installation. The term 'delivery' in reference to any item specified or indicated, means the unloading and storing with proper protection at the project site. Damaged materials or equipment will be rejected and removed from the site by the Contractor.
- 6.3.6 Before ordering materials, equipment, or performing Work, the Contractor shall verify indicated dimensions. If a discrepancy exists, the Contractor shall notify the A/E of same immediately. The A/E will then clarify the intended design. The Contractor shall take field measurements required for the proper fabrication and installation of the Work. Upon commencement of any item of Work, the Contractor shall be

responsible for dimensions related to such item of Work.

6.4 Guarantees/Warranty.

- 6.4.1 The Contractor guarantees and warrants to the Owner that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the A/E or Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This guarantee/warranty is not limited by the provisions of Sub-Article 15.2.
- 6.4.2 The Contractor will indemnify the Owner against loss, including loss of use and lost revenues resulting from a breach of the Contractor's guaranty and warranty under Sub-Article 6.4.1, whether the loss arises before or after the Owner's acceptance of the Project.
- 6.4.3 Where the contract documents provide for equipment and material warranties in addition to the Contractor's guarantees' and warranty contained in Sub-Article 6.4.1, such warranties shall at a minimum:
 - 6.4.3.1 Provide that the term of the warranty shall start on the date of substantial completion of the project or the date the Owner takes beneficial occupancy of any portion of the project that requires the use or start-up of the warranted equipment or material, whichever date occurs first.
 - 6.4.3.2 Provide for complete repair or replacement of defective equipment or material;
 - 6.4.3.3 Provide all materials, shipping, and labor necessary to repair or replace defective equipment or material at no expense to the Owner;
 - 6.4.3.4 Provide that any replacement parts used in repairing or replacing defective equipment or material shall be new or in a like-new condition.
 - 6.4.3.5 Provide for the complete repair or replacement of defective equipment or material within two weeks after receiving written notice of the defect, provided however, that the Owner can, at its sole discretion, grant an extension of time for good cause shown; and
 - 6.4.3.6 Provide for no limitation of liability should the Contractor and/or manufacturer fail to repair or replace defective equipment or material within the time specified in Sub-Article 6.4.3.4 or should the remedy of repair or replacement otherwise fail.
 - 6.4.3.7 Be construed under South Dakota law.
 - 6.4.3.8 Provide that any legal action brought on the warranty shall be brought only in a South Dakota court.
- 6.5 Taxes: The Contractor shall pay all sales, consumer, use, excise, and other similar taxes for the Work or portions thereof which are to be provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective.
- 6.6 Permits, Fees and Notices.
 - 6.6.1 The Contractor shall secure and pay for all permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required at the time the bids are received. The State does not require that inspection and license fees be paid to a municipality for work performed on State property.
 - 6.6.2 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work and shall indemnify the Owner and the A/E against all costs, fines and damages, and all actions, claims and proceedings, due to its failure to do so.

- 6.6.3 The Contractor and its Subcontractors shall acquaint themselves with all codes governing their work and shall complete the work in conformance with all codes governing their work.
- 6.6.4 It is not the responsibility of the Contractor to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Owner and the A/E in writing, and any necessary changes shall be accomplished by appropriate modification.
- 6.6.5 If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner and the A/E, he shall assume full responsibility therefor and shall bear all costs attributable thereto.
- 6.7 Superintendent: The Contractor shall employ a competent superintendent and necessary assistants all of whom are acceptable to the Owner and who shall be in attendance at the Project site during the progress of the Work. The Superintendent shall represent the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be so confirmed on written request in each case. The Superintendent shall not be changed without the Owner's consent.
- 6.8 Construction Progress Schedule.
 - 6.8.1 The Contractor shall, within 5 days, or within such time as determined by the A/E, after date of Notice to Proceed, prepare and submit to the A/E for approval a reasonable schedule showing the critical path, order in which the Contractor proposes to carry on the work and, the date on which he will start the several salient features (including procurement of materials, plant and equipment). The progress schedule shall indicate appropriately the percentage of work scheduled for completion at any time. If at any time the sequence of work is modified, the Construction Progress Schedule shall be updated.
 - 6.8.2 The Construction Progress Schedule shall reflect the time required for the preparation and processing of shop drawings and submittals and the lead time required in connection with the procurement of manufactured or processed materials and equipment.
 - 6.8.3 The Contractor shall furnish sufficient forces, construction plant, and equipment, and shall work such hours, including night shifts, overtime operations, and Sunday and holiday work, as may be necessary to insure the prosecution of the work in accordance with the approved progress schedule.
 - 6.8.4 Whenever major portions of the Work fall behind the planned schedule, the Owner and A/E shall be notified and advised of action being taken to return the project to its original schedule and such action shall be indicated on the Construction Progress Schedule which shall then be reissued. If, in the opinion of the A/E and Owner, the Contractor is not taking adequate steps to improve or maintain the progress of the work, the A/E and Owner may require him to increase the number of shifts, and/or overtime operations, days of work, and/or the amount of construction plant, all without additional cost to the Owner.
- 6.9 Documents and Samples at the Site: The Contractor shall maintain at the site for the Owner one record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data and Samples. These shall be available to the A/E and Owner and shall be delivered to A/E for the Owner upon completion of the Work.
- 6.10 Shop Drawings, Product Data and Samples.
 - 6.10.1 Shop Drawings are drawings, diagrams, schedules or other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.
 - 6.10.2 Product Data are illustrations, standard schedules, performance charts, instructions brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.
 - 6.10.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

- 6.10.4 The Contractor shall submit a schedule for submittal of Shop Drawings, Product Data and Samples to the A/E for review. The Contractor shall review, approve and submit to the A/E, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the A/E or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents, in accordance with the schedule reviewed by the A/E.
 - 6.10.4.1 The A/E reserves the right to review Shop Drawings, Product Data, Samples and submittals in a sequence consistent with the sequence of erection, installation and assembly of the various elements of the Work.
 - 6.10.4.2 The Contractor's identification of Shop Drawings, Product Data and Samples shall include verification of information required in Sub-Articles 6.10.9.2 and 6.10.10.2.
 - 6.10.4.3 No extension of time will be granted, nor will any consideration be given to claims arising out of the Contractor's failure to submit any Shop Drawing, Product Data, Samples or related submittals according to the schedule or otherwise in a manner which does not allow adequate lead time for A/E's review, or does not allow ample time for revision, resubmission and subsequent review by the A/E as required.
 - 6.10.4.4 Composite Drawing: In the interest of coordination and expediting the work in critical areas, i.e. exterior wall components, mechanical/electrical systems, and other areas so requested by the A/E, the Contractor shall prepare and submit, to the A/E for review, Composite Drawings embodying the Work of the various trades and/or Subcontractors involved. After review, the Contractor shall distribute prints or reviewed Composite Drawings to affected trades and/or Subcontractors. The Contractor shall require that the involved trades and/or Subcontractors cooperate in preparation of the Composite Drawings to assure proper coordination between trades and/or Subcontractors. The participating trades and/or Subcontractors shall indicate their approval on these drawings.
- 6.10.5 By approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that he has determined and verified all materials, field measurement, and field construction criteria related thereto, checked the Shop Drawings, Product Data, and Samples for complete dimensional accuracy; that he has checked to insure that work contiguous with and having bearing on the work shown on the Shop Drawings is accurately and clearly shown, that he has checked the Shop Drawings against the Composite Drawings prepared by the Contractor, that the Work has been coordinated and that the equipment will fit into the assigned spaces, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Construction Documents.
 - 6.10.5.1 Any Shop Drawing, Product Data or Sample submitted without Contractor's approval will not be processed for review by the A/E, but will be returned to the Contractor for his compliance with the above procedures, in which event it will be deemed that the Contractor has not complied with the provisions herein specified and the Contractor shall bear the risk of all delays as if no Shop Drawing, Product Data and Sample had been submitted.
 - 6.10.5.2 Shop Drawings shall bear a coordination and approval stamp signed by the Contractor and each contiguous Subcontractor, which shall confirm the representations set forth in Sub-Article 6.10.5. Shop Drawings shall bear the seal of a registered professional engineer or A/E when required by the Specifications or State Law.
- 6.10.6 The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Construction Documents by the A/E's approval of Shop Drawings, Product Data or Samples under Sub-Articles 4.10 and 6.10.9 unless the Contractor has specifically informed the A/E in writing of such deviation at the time of submission and the A/E has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the A/E's approval thereof. Any deviation shall also be indicated on such Shop Drawing, Product Data, Sample, or related submittal by circling or other approved means.

- 6.10.7 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the A/E on previous submittals. Unless such written notice has been given, the A/E's Action on a resubmitted Shop Drawing, Product Data, or Sample shall not constitute Review and Action of any changes not requested on the prior submittal.
- 6.10.8 No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been approved by the A/E as provided in Sub-Article 6.10.9. All such portions of the Work shall be in accordance with approved submittals.
 - 6.10.8.1 No Shop Drawing, Product Data or Sample shall be issued to the field without the A/E's Action Stamp affixed thereto.
- 6.10.9 Shop Drawing & Product Data Procedures
 - 6.10.9.1 Shop Drawing Requirements: Shop Drawings shall show design, materials (kind, thickness and finish), dimensions, connections, rough openings, routing details, and other details necessary to insure that they accurately interpret Contract Drawings and Specifications and also show adjoining work in such detail as required to provide proper connection with same. Shop Drawings shall be numbered consecutively and insofar as possible shall be uniform in size.
 - 6.10.9.2 Identification: All Shop Drawings and Product Data shall be identified with the name of the Project, Project Number, building or buildings for which the Shop Drawings and Product Data are being submitted, and shall contain the A/E's name, Contractor's name, Subcontractor's name, date of submittal, drawing number, revision, if any, as well as the Specification Section under which the Work is to be performed and the Drawing and detail numbers that relate to the Shop Drawings and Product Data.
 - 6.10.9.3 Transmittals: All Shop Drawings and Product Data shall be accompanied by a letter of transmittal from the Contractor setting forth the same identification information as required above under Sub-Article 6.10.9.2. Contractor shall number transmittals consecutively in sequence with the sample transmittals and shall indicate the Submittal Procedure number being followed. Transmittal shall also indicate if Shop Drawing is resubmittal and note A/E's file number for original submittal.
 - 6.10.9.4 Submittal Procedures: The Contractor shall submit copies of Shop Drawings and Product Data to the A/E in accordance with the Submittal Procedures listed below.
 - 6.10.9.4.1 Shop Drawings and Product Data shall be sent by the Contractor to the Architect/Engineering team.
 - 6.10.9.4.2 Shop Drawings and Product Data can be sent via an electronic method (email or other electronic platform) or via original paper copy. Contract, Architect/Engineer, and Owner shall agree on submittal method (email, other electronic platform, original paper copy, etc.).
 - 6.10.9.4.3 Shop Drawings and Product Data shall be clearly legible and physical product samples shall be provided whenever necessary.
 - 6.10.9.5 A/E's Distribution & Stamp: Following the A/E's review of each Shop Drawing and Product Data submission, the A/E will retain a copy of the submittal for their records as well as return a copy to the Contractor and Owner with the A/E's stamp and signature affixed thereto, annotated as follows:
 - 6.10.9.5.1 "A Action": "A Action" means the submission is in general conformance with the design concept. Construction, fabrication and/or manufacture can proceed subject to the provision that the Work shall be in accordance with the requirements of the Construction Documents. Final acceptance of the Work shall be contingent upon such compliance.
 - 6.10.9.5.2 "B Action": "B Action" means the submission is in general conformance with the design concept subject to notations by the A/E on the returned Shop Drawings. Construction, fabrication and/or manufacture can proceed subject to the provision

that the Work shall be carried out in compliance with all annotations and/or corrections indicated on the returned Shop Drawings and Product Data and in accordance with the requirements of the Construction Documents. Final acceptance of the Work shall be contingent upon such compliance.

- 6.10.9.5.3 "C Action": "C Action" means that the Contractor shall revise and resubmit the Shop Drawings and Product Data in accordance with all annotations and/or corrections indicated therein. Construction, fabrication and/or manufacture cannot proceed. Shop Drawings and Product Data bearing "C Action" stamp shall not be permitted on the Project Site.
- 6.10.9.5.4 "D Action": "D Action" means that the submission is rejected for nonconformance with the design concept and the Contractor shall make a new submittal which shall comply with the requirements of the Construction Documents. Construction, fabrication and/or manufacture cannot proceed. Shop Drawings and Product Data bearing "D Action" stamp shall not be permitted on the Project Site.
- 6.10.9.6 Contractor's Distribution: When transparencies are returned "A Action" or "B Action", the Contractor shall obtain and provide such number of prints to the Subcontractor as may be required by the Subcontractor for his distribution. The Contractor shall have copies of all "A Action" or "B Action" Shop Drawings and Product Data at the Project Site at all times and shall make them available to the A/E's representatives.
- 6.10.9.7 Cost of Submittal and Distribution: All charges in connection with the delivery of Shop Drawings and Product Data to the A/E shall be paid by the Contractor. All charges in connection with the distribution of Shop Drawings and Product Data to the Contractor shall be paid by the Contractor.

6.10.10 Samples Procedures

- 6.10.10.1 Sample Requirements: Where possible, all samples required for a particular Specification Section shall be submitted together.
 - 6.10.10.1.1 Samples shall be submitted from the same source which will supply the actual job. Samples shall be of adequate size to show quality, type, color, range, finish, texture and other specified characteristics.
 - 6.10.10.1.2 Samples of materials or products which are normally furnished in containers or packages, which bear descriptive labels and/or application or installation instructions, shall be submitted with such labels and/or instructions.
- 6.10.10.2 Identification: All Samples shall be labeled, tagged, or otherwise clearly identified. Labels or tags shall set forth the name of the Project, the project number, buildings for which the Sample is being submitted, A/E, Contractor, Subcontractor, and/or supplier, the name of the manufacturer, fabricator, or processor, the trade designation, grade and quality of the material or product, the date of submittal, and specific identification of each sample and a precise reference to the Specification Article and Sub Article wherein the material, product, or element of the Work is specified. Each label or tag shall have sufficient clear space to permit the application of the approval stamp of the Contractor, and the action stamp of the A/E.
- 6.10.10.3 Transmittals: All samples shall be accompanied by a letter of transmittal from the Contractor setting forth the same identification information as required above under Sub-Article 6.10.4.2.

Contractor shall number transmittals consecutively in sequence with the Shop Drawings and Product Data transmittals. Where appropriate, test data and/or manufacturers' certificates shall be referenced in and forwarded with the letter of transmittal. Samples without accompanying certificates or test data will be returned without action.

6.10.10.4 Submittal Procedure: The Contractor shall submit the number of samples as indicated below:

- 6.10.10.4.1 In the event that a range of variations in texture, graining, color or other characteristics may be anticipated in furnished materials, assemblies, or elements of the Work, a sufficient number of samples of such materials or products shall be submitted to indicate the full range of characteristics which will be present in the materials or products proposed for the Work. Any such materials or products delivered or erected prior to approval of full range samples shall be subject to rejection.
- 6.10.10.4.2 All Samples shall be submitted in triplicate to the A/E's home office, or where directed by the A/E, except as otherwise set forth in other Sections of the Contract Documents.
- 6.10.10.5 A/E's Distribution & Stamp: Following the A/E's review of each Sample submission, the A/E will return one set of each submission to the Contractor with the A/E's stamp and signature affixed thereto and annotated in a manner conforming to the convention established in Sub- Article 6.10.9.5.
- 6.10.10.6 Contractor's Distribution: When Samples are returned 'Action A' or 'Action B', the Contractor shall retain such Samples in a suitable place at the Project Site for use by the Contractor, his Subcontractors, the A/E and his authorized representatives to insure that all work is being installed in accordance with these Samples. The remaining Samples will be retained by the A/E.
- 6.10.10.7 Cost of Submittal and Distribution: All charges in connection with the delivery of Samples to the A/E's home office or where directed by A/E (and all charges in connection with the subsequent distribution thereof by the A/E) shall be paid by the Contractor.

6.11 Use of Site.

- 6.11.1 The Contractor shall confine operations at the Site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the Site with any unnecessary or surplus materials or equipment or debris.
- 6.11.2 Notwithstanding the designation of construction limits or the indication of temporary fences or barricades, the provisions of the Contract Documents governing certain portions or phases of the Work may require that certain operations be carried out beyond such designated limits. Trenching, utility work, site development, landscaping and all other work, if required beyond such designated limits, shall be scheduled in such a manner as to cause or occasion a minimum of inconvenience or disturbance or interference with the normal operation of the Owner, abutters, and the public. The Contractor shall obtain the Owner's prior approval for such operations, prosecute such operations expeditiously and restore the affected area and other areas needed for access to their original condition immediately upon completion of such operations, unless otherwise specified herein.
- 6.11.3 All operations, including pumping, draining and control of surface and ground water shall be carried out so as to avoid endangering the Work of any adjacent facility or property, or interrupting, restricting or otherwise infringing or interfering with the use thereof.
- 6.11.4 The Contractor shall confine operations at the site to work related activities. The Contractor shall not use the site for lodging or as a personal residence.
- 6.12 Cutting and Patching of Work.
 - 6.12.1 The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work or to make its several parts fit together properly.
 - 6.12.2 The Contractor shall not damage or endanger any portion of the Work or the work of the Owner or any separate contractors or adjacent facilities by cutting, patching or otherwise altering any work, or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner or any separate contractor except with the written consent of the Owner and of such separate contractor. The Contractor shall not unreasonably withhold from the Owner or any separate contractor his consent to cutting or otherwise altering the Work.

- 6.12.3 Structural elements of the Work shall not be cut, patched or otherwise altered or repaired without prior written authorization by the A/E.
- 6.12.4 Authorization to proceed with remedial operations for any damaged or defective element or portion of the Work shall not constitute a limitation or a waiver of the A/E's right to require the removal and replacement of any work which fails to fulfill the requirements of the Contract Documents.

6.13 Cleaning Up.

- 6.13.1 The Contractor at all times shall keep the Site and related streets free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work he shall remove all his waste materials and rubbish from and about the Project as well as his tools, construction equipment, machinery and surplus materials. All waste and rubbish shall be removed from the Site at least weekly and more often if necessary.
- 6.13.2 If the Contractor fails to maintain a clean and safe Project and/or fails to clean up at the completion of the Work, the Owner may do so as provided in Sub-Article 5.3 and the cost thereof shall be charged to the Contractor.
- 6.14 Communications: Except where otherwise directed by the A/E or otherwise provided in the Contract Documents, the Contractor shall forward all communications to the Owner through the A/E.
- 6.15 Royalties and Patents: The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof, except that the Owner shall be responsible for all such loss when a particular manufacturer or manufacturers is specified, but if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the A/E and Owner in writing.
- 6.16 Indemnification.
 - 6.16.1 To the fullest extent permitted by law, the Contractor shall indemnify, defend and hold harmless the Owner, the A/E and its consulting engineers, and their respective successors, agents and employees from and against all claims, damages, liabilities, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (including the Work itself) including the loss of use resulting therefrom, and (2) is caused in whole or in part by any tortious act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. Such obligations shall not be construed to negate, abridge or otherwise reduce any other right or obligation or indemnity which would otherwise exist as to any party or person described in this Sub-Article 6.16.
 - 6.16.2 In any and all claims against the Owner, the A/E or any of its consultants, and their respective successors, agents or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Article 6.16 shall not be limited in any way by any limitation on the amount or type of damages, compensations or benefits payable by or for the Contractor or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.
 - 6.16.3 The obligations of the Contractor under this Sub-Article 6.16 shall not extend to indemnification of the A/E or other design consultants employed by him, his consultant, agents or employees for damages, claims, losses or expenses arising out of: (a) the preparation or approval by the A/E or his design consultants of maps, drawings, opinions, reports, Change Orders, designs or specifications, or (b) the giving of or the failure to give directions or instructions by the A/E or his design consultants provided such giving or failure to give is the primary cause of the damage, claim, loss or expense.
 - 6.16.4 The Contractor agrees to defend, indemnify and save the Owner, and A/E, or any of its consulting engineers, and their respective successors, agents or employees harmless from all costs, liabilities, damages or expenses, including reasonable attorneys' fees, incurred by them, by virtue of any claim or

claims whatsoever filed by any Subcontractor, Sub-subcontractor, mechanic, laborer or materialman making claims arising from the Work by, through, or under the Contractor. The Contractor also hereby agrees to defend, indemnify and hold harmless, protect, and defend the Owner, the A/E and its consulting engineers, and their respective successors, agents or employees from and against any liability, claim, judgment, loss, damage, including but not limited to direct, indirect and incidental and consequential damages, attorneys fees, court costs and expense of collection, occasioned in whole or in part by the failure of the Contractor, its Subcontractor, or Sub-subcontractors to comply with any of the terms or provisions of the Contract Documents.

6.16.5 This article does not require the Contractor to indemnify the Owner, its officers, agents, or employees from claims or liability arising solely from the acts or omissions of the Owner, its officers, agents, or employees.

6.17 Default.

- 6.17.1 The Contractor shall be in default of the Contract if:
 - 6.17.1.1 Contractor refuses or fails to prosecute the Work in accordance with the Contract Documents in any material respect;
 - 6.17.1.2 Contractor fails to make proper payment to Subcontractors or for materials or labor (provided Owner shall have paid to Contractor any payments due from Owner in connection with such materials or labor);
 - 6.17.1.3 Contractor disregards laws, ordinances, rules, building codes and regulations or orders of any public authority having jurisdiction;
 - 6.17.1.4 Contractor fails to coordinate its work with other contractors and Subcontractors as required under Article 8 of these General Conditions;
 - 6.17.1.5 Contractor fails to comply with the scheduling requirements of the Contract;
 - 6.17.1.6 Contractor fails to promptly replace rejected material or correct rejected workmanship; or
 - 6.17.1.7 Contractor fails in any material respect to observe any other terms, provisions, conditions, covenants and agreements in the Contract to be observed and performed on the part of the Contractor.
- 6.17.2 In the event of any default by Contractor under the Contract, Owner shall have the right to take such measures as it deems necessary to correct the default, at the Contractor's sole cost and expense and to deduct such costs, including but not limited to the State Engineer's and A/E's fees, as it may incur from amount otherwise owing to the Contractor, or to terminate the Contract in accordance with Sub-Article 16.2 of the General Conditions in addition to any and all other remedies that Owner may now or hereafter have. If the amounts owing to the Contractor are insufficient to cover the Owner's cost of corrections, the Contractor shall pay such amount promptly upon demand.

Article 7

SUBCONTRACTORS

7.1 Definitions.

- 7.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site. The term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative. The term Subcontractor does not include any separate contractor or his subcontractors.
- 7.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform any of the Work at the site. The term Sub-subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub- subcontractor or an authorized representative thereof.
- 7.2 Award of Subcontracts and Other Contracts for Portions of the Work. The Contractor shall conduct an investigation of each of its proposed Subcontractor's capabilities to assure each is responsible and has the requisite experience, skill, physical plant, and financial strength necessary to perform each Subcontractor's respective Work. The Contractor shall not contract with any Subcontractor that is not responsible or does not have the requisite experience, skill, physical plant, and financial strength necessary to perform its part of the Work.

- 7.3 Subcontractual Relations.
 - 7.3.1 The Contractor shall not include any provisions in its Contracts with its Subcontractors which will in any way prejudice the rights of the Owner and the Architect/Engineer under the Contract between the Owner and the Contractor.
 - 7.3.2 The Subcontract agreement shall require the Subcontractor to consent to any assignment of the Subcontract to the Owner in the event of a default by the Contractor hereunder.
 - 7.3.3 Nothing in Article 7 shall be construed to create a privity of Contract between the Owner and any Subcontractor.

Article 8 WORK BY OWNER OR BY SEPARATE CONTRACTORS

- 8.1 Owner's Right to Perform Work and to Award Separate Contracts.
 - 8.1.1 The Owner reserves the right to perform work related to the Project with his own forces, and to award separate contracts in connection with such work. Such work may include Work assigned to the Contractor under the Contract Documents which Work is not being performed properly or in accordance with the scheduling provisions of the Contract Documents, whether or not the Contractor is in default under Sub-Article 6.17 and whether or not the Owner has terminated the Contract under Sub-Article 16.2. If the Owner elects to exercise this right it will do so upon reasonable notice to the Contractor. There shall be an appropriate adjustment in amounts payable to the Contractor to reflect the Work undertaken by the Owner, which the parties shall confirm by Change Order in accordance with Article 14. If the Contractor claims that delay is involved because of such action by the Owner, he shall make such claim as provided elsewhere in the Contract Documents.
 - 8.1.2 When separate contracts are awarded for different portions of the Project or other work on the site, the term Contractor in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.
 - 8.1.3 The Owner will provide for the coordination of the work, of his own forces and of each separate contractor with the Work of the Contractor, who shall cooperate therewith as provided in Sub-Article 8.2.
- 8.2 Mutual Responsibility.
 - 8.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity and all required facilities for the introduction and storage of their materials and equipment and the execution of their work, and shall connect and coordinate his Work with theirs as required by the Contact Documents.
 - 8.2.2 If any part of the Contractor's Work depends for proper execution or results upon the work of the Owner or any separate contractor, the Contractor shall, prior to proceeding with the Work, promptly report to the A/E any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results. Failure of the Contractor to report shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive his Work, except as to defects which may subsequently become apparent in such work by others.
 - 8.2.3 Any costs caused by defective or ill-timed work shall be borne by the party responsible therefor.
 - 8.2.4 Should the Contractor wrongfully cause damage to the work or property of the Owner or of a separate Contractor, or to other work on the site, the Contractor shall promptly remedy such damage as provided in Sub-Article 12.2.5.
 - 8.2.5 Should the Contractor wrongfully cause damage to the work or property of any separate contractor, the Contractor shall upon due notice promptly attempt to settle with such other contractor by agreement, or otherwise to resolve the dispute. If such separate contractor sues or initiates a litigation proceeding against the Owner on account of any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor who shall participate in the defense of such proceedings at the Contractor's expense, and if any judgment or award against the Owner arises therefrom the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorneys' fees and court costs which the Owner has incurred.

8.3 Owner's Right to Clean Up: If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up the Project, the Site and related streets and walks on a routine basis as required by Sub-Article 6.13, the Owner may clean up and charge the cost thereof to the contractors responsible therefore as the Owner shall determine to be just.

Article 9 MISCELLANEOUS PROVISIONS

- 9.1 Governing Law: The Contract shall be governed by South Dakota Law.
- 9.2 Successors and Assigns: The Owner and the Contractor each binds himself, his successors, assigns and legal representatives to the other party hereto and to the successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Owner, nor shall the Contractor assign any money due or to become due to him hereunder, without the previous written consent of the Owner.
- 9.3 Written Notice: All notices, demands and other communications hereunder shall be in writing and shall be deemed to have been given if sent pursuant to Article VII of the Agreement for Construction.
- 9.4 Claims for Damages: Should either party to the Contract suffer injury or damage because of any act or omission of the other party or of any of his employees, agents or others for whose acts he is legally liable, claim shall be made in writing to such other party within 14 days after the first observance of such injury or damage.
- 9.5 Performance and Labor and Material Payment Bond: Before commencing the Work, the Contractor shall provide a Performance and Labor and Material Payment Bond in accordance with the requirements of the Instructions to Bidders.
- 9.6 Rights and Remedies.
 - 9.6.1 The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. This provision relates particularly to the Contractor's obligations under Sub-Article 15.2.2.
 - 9.6.2 No action or failure to act by the Owner, A/E or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.
- 9.7 Tests.
 - 9.7.1 If the Construction Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the A/E and Owner timely notice of its readiness so the A/E and Owner may observe such inspection, testing or approval. The Contractor shall perform and bear all costs of such inspections, tests and approvals, unless otherwise provided.
 - 9.7.1.1 Where certain testing and inspection requirements are set forth in the various Sections of the Construction Documents to be performed at the expense of the Owner, the Owner will retain the services of testing laboratories, agencies, or consultants, to perform such tests or inspections and render such services as may be required to verify that the work fulfills the requirements and intent of the Construction Documents. Such services will be performed in a manner consistent with the requirements of the Owner and the various agencies having jurisdiction over the Work and in accordance with reasonable standards of architectural and engineering practice.
 - 9.7.1.2 The Owner reserves the right to modify the scope of or to re-allocate any of the testing and inspection services specified in the various Sections of the Construction Documents to be performed by a testing laboratory, agency or consultant retained by the Owner in connection with the Work when it can be satisfactorily established that such adjustment in scope is consistent with

the intent of the Construction Documents. In the event that the Contractor shall not concur with such modification of scope or re-allocation of such services, he shall immediately notify the A/E and Owner in writing.

- 9.7.2 If the A/E determines that any Work requires special inspection, testing, or approval which Sub- Article 9.7.1 does not include, he will upon written authorization from the Owner, order the performance of such services by qualified independent testing laboratories, agencies or consultants as may reasonably be required or instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided in Sub-Article 9.7.1. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Construction Documents, the Contractor shall bear all costs thereof, including the cost of the tests, correction of the Work, the cost of retesting, and compensation for the A/E's additional services made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate Change Order shall be issued.
 - 9.7.2.1 If A/E's observation or any inspection or testing undertaken pursuant to Sub-Article 9.7 reveals a failure in any one of a number of identical or similar items or elements incorporated in the Work to comply with (1) the requirements of the Construction Documents or, (2) with respect to the Performance of the Work, with laws, ordinances, rules, regulations, building codes or orders of any public authority having jurisdiction, the A/E will have the authority to order inspection and/or testing of all such items or elements of the Work, or of a representative number of such items or elements of the Work, as he may in his reasonable opinion consider necessary or advisable, and the Contractor shall bear all costs thereof, including the cost of the tests, correction of the Work, the cost of retesting, and the A/E's additional services, if any are required, made necessary thereby. However, neither the A/E's authority to act under Sub-Article 9.7 nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the A/E to the Contractor, any Subcontractor, any of their agents or employees, or any other person performing any of the Work.
- 9.7.3 Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the A/E and the Owner.
 - 9.7.3.1 The Contractor shall obtain and deliver promptly to the Owner any certificates of final inspection of any part of his Work or operating permits for any mechanical or electrical apparatus, such as elevators, escalators, boilers, air compressors, fire alarms, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Except as is otherwise provided in Sub-Article 10.1.3, receipt of such permits or certificates by the Owner shall be a condition precedent to Completion of the Work.
 - 9.7.3.2 Copies of reports issued as a result of services performed at the expense of the Owner pursuant to the provisions of this Article will be distributed to all parties to the Contract.
- 9.7.4 If the A/E or owner is to observe the inspections, tests or approvals required by the Contract Documents, they will do so promptly and, where practicable, at the source of supply.
- 9.7.5 In connection with testing and inspection services performed at the expense of the Owner, the Contractor shall provide Samples of materials and/or elements of the Work required as test specimens and shall provide incidental labor and facilities at the site reasonably required in support of such services.
- 9.7.6 The cost of testing services required solely for the convenience of the Contractor in his scheduling and performance of the Work shall be borne by the Contractor.
- 9.7.7 The cost of testing services related to remedial operations performed to correct deficiencies in the Work shall be borne by the Contractor.
- 9.7.8 If, during the course of the performance of any testing, inspection, control, balancing, adjusting, or similar work by the Contractor or an agent of the Contractor, it is the opinion of the A/E that the Contractor or said agent has failed to perform such work in a satisfactory manner, the Contractor shall, at his own expense, retain the services of a service organization which is satisfactory to the A/E for the performance of such work.

9.8 Litigation.

- 9.8.1 Unless otherwise specifically provided in this Agreement, all claims, counter-claims, disputes or other matters in question between the Owner and the Contractor arising out of, or relating to this Agreement, or the breach thereof, will be decided by direct negotiations, by non-binding mediation if the parties mutually agree, or in a circuit court of competent jurisdiction within the State of South Dakota. Notice of a request for mediation shall be sent in writing to the other party to this Agreement within a reasonable time after the claim, dispute, or other matter in question has arisen. If the party receiving notice of request does not agree to mediation in writing within 10 calendar days, it will be deemed that the parties do not mutually agree to mediate the matter. If the parties agree to mediate, a mediator to hear the dispute will be agreed upon by the parties. If agreement on a mediator cannot be reached, the State shall select the mediator.
- 9.8.2 The Contractor shall carry on the Work and maintain its progress during any dispute or litigation proceedings, and the Owner shall continue to make payments to the Contractor to the extent required by the Contract Documents and South Dakota Law.

Article 10 TIME

10.1 Definitions.

- 10.1.1 The Contract Time is the period of time allotted in the Construction Contract for Substantial Completion of the Work as defined in Sub-Article 10.1.3, including authorized adjustments thereto.
- 10.1.2 The date of commencement of the Work is the date established in the Notice to Proceed.
- 10.1.3 The date of Substantial Completion of the Work is the date certified by the A/E when construction is sufficiently completed in accordance with the Contract Documents so that the Owner can occupy and utilize the Project for the use for which it is intended, and such Work is fully completed in accordance with the Contract Documents except for minor items, adjustments or corrections which have no material effect upon the utilization, function or intrinsic values of the entire Project, including all of its mechanical, electrical and other systems and facilities.
- 10.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically designated.
- 10.2 Progress and Completion.
 - 10.2.1 All time limits stated in the Contract Documents, including the Construction Completion Schedule, are of the essence of the Contract.
 - 10.2.2 The Contractor shall begin the Work on the date of commencement as defined in Sub-Article 10.1.2. He shall carry the Work forward expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.
- 10.3 Delays and Extensions of Time.
 - 10.3.1 If the Contractor is delayed at any time in the progress of the Work by any act or neglect of the Owner or the A/E, or by any employee of either, or by changes in the Construction Completion Schedule required by the Owner, or by any separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes not caused by the labor practices of the Contractor or any Subcontractor in contravention of applicable labor practices, fire, unusual delay in transportation, severe and unusual weather conditions not reasonably anticipatable, unavoidable casualties, or any other causes beyond the Contractor's control and not occurring due to the fault or neglect of the Contract, any Subcontractor or any other person for whose acts the Contractor is responsible, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner shall determine, or the Owner may elect to require the Contractor to accelerate the Work, in which case the Contract Sum shall be increased by a Change Order in the amount of the direct cost to the Contractor (exclusive of overhead and profit of necessary over-time labor).

- 10.3.2 Any claim for extension of time shall be made in writing to the Owner with a copy to A/E not more than 10 days after the commencement of the delay; otherwise it shall be waived. In the case of continuing delay only one claim is necessary. The Contractor shall provide an estimate of the probable effect on such delay on the progress of the Work.
 - 10.3.2.1 Such claims shall set forth in detail the nature of the circumstances which form the basis for each such claim, the date upon which each such alleged cause of delay began, or began to affect the timely prosecution of the Work, and ended, or ceased to have an adverse effect upon the timely prosecution of the Work, and the number of days extension of time requested as a consequence of each such alleged cause of delay. The Contractor shall provide such supporting documentation as the Owner may require, including, where appropriate, a revised Construction Completion Schedule indicating all of the activities affected by the circumstances which form the basis for the claim.
 - 10.3.2.2 The Contractor shall not be entitled to a separate extension of time as a consequence of each one of a number of causes of delay which may have a concurrent or interrelated effect on the progress of the Work.
 - 10.3.2.3 The Owner shall have the right to defer his decision or decisions with reference to any claim or claims for an extension of time made pursuant to the provisions of this Article until the facts or circumstances which form the basis for such claim or claims may be fully assessed to the Owner's reasonable satisfaction.
 - 10.3.2.4 Notwithstanding the provisions of Sub-Article 10.3.2, claims for an extension of time arising out of authorized changes in the Work shall be made in writing prior to or concurrent with the submission of the Contractor's proposal pursuant to such change. No extension of time arising out of changes in the Work will be granted subsequent to the date upon which the Contractor is authorized to proceed with such change or changes in the Work unless specific provisions governing a subsequent determination of an extension of time have been incorporated in such authorization to proceed with such change or changes in the Work. No claim for damages or separate compensation for delay arising from such change in the Work shall be recognized or be deemed valid, it being understood that any additional cost to the Contractor arising from such change shall be included in the amended Contract Sum set forth in such Change Order.
 - 10.3.2.5 Time extensions will not be granted for rain, wind, snow, or other natural phenomena of normal intensity for the locality where work is performed. Determinations of the extent of delay attributable to unusual weather phenomena shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climactic range during the same period on the calendar. National Oceanic and Atmospheric Administration National Weather Service statistics for the locality or area where the work is performed shall be used to determine the five (5) year average weather conditions. Time extensions for weather delays do not entitle the Contractor to "extended overhead" recovery.
- 10.3.3 If no agreement is made stating the dates upon which interpretations as provided in Sub-Article 4.13 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until 15 days after written request is made for them, and not then unless such claim is reasonable.
- 10.3.4 Should the contractor fail to substantially complete the work within the time agreed upon in the contract documents, or within such extra time as may have been allowed by increases in the contract or by formally approved extensions granted by the owner, the contractor and the contractor's surety shall be liable for and shall pay the owner the sums stipulated in the agreement for construction as liquidated damages for each calendar day of delay until the work is substantially complete. This sum is not a penalty but is liquidated damages due the owner from the contractor by reason of inconvenience to the public, added cost of engineering and supervision, and other items which have caused an expenditure of public funds resulting from the contractor's failure to complete the work within the time specified in the contract. In addition to liquidated damages, if any delay on the part of the contractor, any subcontractor or subsubcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable results in any claim by third parties against the owner or the A/E arising out of such

delay, the contractor shall pay, satisfy, and discharge all losses, damages and expenses arising out of such claims, including attorneys' fees, and shall indemnify and hold harmless the owner and the A/E and their agents and employees from and against all costs, fees, losses, damages, and expenses arising out of such claims enforced against the owner or the A/E.

- 10.3.5 No extension of time will be granted to the Contractor for any delay other than those described in Sub-Article 10.3.1.
 - 10.3.5.1 Should the Contractor fail, refuse or neglect to supply a sufficiency of workmen or to deliver the materials with such promptness as to prevent delay in the progress of the Work, or fail in any material respect diligently to commence and prosecute the Work and to proceed in accordance with the approved construction schedule, or if the different parts thereof are not commenced, prosecuted, finished, delivered or installed in such manner as will insure substantial completion in accordance with the approved Construction Completion Schedule, or if the Contractor shall fail in the performance of any of his obligations under this Contract in any material respect, the Owner shall have the right to direct the Contractor, upon 3 days notice at the Contractor's cost and expense, to furnish such additional labor and to expedite deliveries of materials (or the Owner may furnish such labor and expedite such deliveries at the cost of the Contractor), which labor or expediting shall, in the Owner's opinion, be sufficient to speed up and complete the Work in accordance with the Construction Completion Schedule.
 - 10.3.5.2 If such additional labor shall not be available, the Owner shall have the right to direct the Contractor at the latter's own cost and expense, to work overtime to such an extent as will be sufficient, in the Owner's opinion, to speed up and complete the Work as herein provided.
- 10.3.6 The Contractor's right to make a claim or claims for an extension of time, as provided in Sub-Article 10.3.1, shall not preclude the Contractor's right to make a claim for delay damages arising out of the Owner's significant interference, by action or inaction, with the Contractor's Work.
- 10.4 Beneficial Occupancy.
 - 10.4.1 The Owner shall have the privilege of Beneficial Occupancy and the use and benefit of designated areas, subdivisions or portions of the Project prior to completion and acceptance of the entire Project, provided that such Beneficial Occupancy shall not unduly interfere with the Contractor's operations nor unduly delay him in completing the entire Work. Such occupancy and use shall be further subject to the provisions set forth herein and the provisions of SDCL § 5-18B-13.
 - 10.4.2 In the event that the Owner desires to exercise the privilege of Beneficial Occupancy, he shall give reasonable notice to the A/E and the Contractor. If the A/E determines that such proposed occupancy is reasonable and proper, the Contractor shall cooperate with the Owner in providing services and facilities reasonably required for the health, safety and comfort of the occupants and other parties lawfully present and/or entering or leaving the premises. Mutually acceptable arrangements shall be made between the Owner and the Contractor with regard to procedures, terms and conditions governing the operation and maintenance of such services and facilities as may be utilized for the benefit of the Owner. The Owner will assume proportionate and reasonable responsibility for operation of systems, equipment and/or utilities required to provide such services, in part or in total, including proportionate and reasonable expenses of operation incidental thereto. No such Beneficial Occupancy shall accelerate the commencement of any warranty period on any system but only on the particular components being utilized.
 - 10.4.3 The Owner's Beneficial Occupancy or use of such designated areas, subdivisions, or portion of the Work shall not constitute acceptance of systems, materials, or elements of the Work which are not in accordance with the requirements of the Contract Documents; nor relieve the Contractor from his obligations to complete the Work; nor for responsibility for loss or damage due to or arising out of defects in, or malfunctioning of, systems, materials, equipment, or elements of the Work; nor from other unfulfilled obligations or responsibilities of the Contractor under the Contract. If, however, damage results solely from any act of the Owner, the Owner will assume its proportionate responsibility for such damage.

Article 11 PAYMENTS AND COMPLETION

- 11.1 Contract Sum: The Contract Sum is stated in the Agreement for Construction.
- 11.2 Schedule of Values: Before the first Application for Payment, the Contractor shall submit to the Owner and A/E a schedule of values allocated to the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Owner and A/E may require. The format and number of copies of such Applications for Payment shall be as directed by the Owner and the A/E. This schedule, unless objected to by the Owner, shall be used as a basis for the Contractor's Applications for Payment.
- 11.3 Monthly Application for Payment.
 - 11.3.1 No later than the 5th day of each month the Contractor shall submit to the A/E his monthly itemized application for Payment. The Contractor shall not submit more than one pay application per month. The monthly Application for Payment shall be on AIA Document G702 and supported by such data substantiating the Contractors right to partial payment as the Owner or A/E may require; including but not limited to receipts, releases, and waivers of liens.
 - 11.3.1.1 In applying for payment, the Contractor shall submit his monthly payment estimate based upon the approved schedule of work for the project, itemized in such form and supported by such evidence as will show his right to the payment claimed. Claims made on account of materials delivered and suitably stored at the site, but not incorporated in the work, shall be conditioned upon submission by the Contractor of Bills of Sale or such other procedure as will establish the Owner's title to such material or otherwise adequately protect the Owner's interest.
 - 11.3.1.2 If the Contractor chooses to apply for payment for materials which cannot be incorporated into the Work, and cannot be stored on the site, he may do so provided the following conditions are met:

Unless otherwise agreed to by the Owner, the material shall be stored in a bonded or insured commercial warehouse within a geographic radius of 15 miles of the construction site, with the Owner being listed on the bond or insurance certificate as the sole beneficiary in the case of loss or damage to the stored materials. The Contractor shall be responsible for all storage, insurance or transportation costs associated with the materials. Conditions of insurance will apply to applicable portions of Sub-Article 11.3.1.2. Contractor shall provide the Owner with bills of sale or such other documents as will establish the ownership of the materials.

- 11.3.2 The Contractor warrants that title to all Work, materials and equipment covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article as "liens"; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor, or by any other person performing Work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.
- 11.3.3 Monthly applications received after the 5th day of the month will be treated as if submitted on the 5th day of the following month.
- 11.4 Recommendation for Payment.
 - 11.4.1 By the 15th of each month, the A/E will review the Contractors Monthly Application for Payment and make his certification to the Owner with a copy to the Contractor, for such amount as the A/E believes is properly due, or notify the Contractor in writing his reasons for withholding a Certificate as provided in Sub-Article 11.6.1.
 - 11.4.2 The issuance of a Certification for Payment will constitute a representation by the A/E to the Owner, based on his observations at the site as provided in Sub-Article 4.3 and the data comprising the Monthly Application for Payment, that the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents

(subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to the result of any subsequent tests required by or performed under the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in his Certificate); and that the A/E believes that the Contractor is entitled to payment in the amount recommended. However, by issuing a Certification for Payment, the A/E shall not thereby be deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examination to ascertain how or for what purpose the Contractor has used the moneys previously paid on account of the Contract Sum. The Owner will not be bound by the amount stated in the A/E's Certification for Payment in making determinations of amounts properly payable to the Contractor.

11.5 Progress Payments.

- 11.5.1 Based upon his review of the Monthly Application for Payment, and the A/Es Certification, the Owner shall make progress payments to the Contractor in such amounts as the Owner reasonably determines are properly due less the aggregate of previous payments in each case. Payment of amounts determined to be due by the Owner under each Monthly Application for Payment shall be due to the Contractor 20 days after the 15th of each month. unless the A/E's certification was delayed by following the procedures of Article 11.6.1. In such case, payment shall be 25 days after the 15th of each month. The Owner shall at all times retain an amount sufficient to complete the Work pursuant to SDCL .§§ 5-18B-11 and 5-18B-13. If the Owner retains any portion of a certified progress payment that is properly due and undisputed beyond the time for payment specified herein and for reasons other than those required by statute, the Owner shall owe and pay the Contractor four percent (4%) interest compounded annually on the retained amount starting from the date payment first becomes due under this article.
- 11.5.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's Work, the amount to which said Subcontractor is entitled reflecting any amounts actually withheld, if any, from payments to the Contractor on account of such Subcontractor's Work. The Contractor shall not withhold retainage from its Subcontractors unless retainage is withheld from the Contractor by the Owner. The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payments to his Sub-subcontractors in similar manner.
- 11.5.3 The Owner shall, on request, furnish to any Subcontractor, if practicable, information regarding the percentages of completion or the amounts applied for by the Contractor and the action taken thereon by the Owner on account of Work done by such Subcontractor.
- 11.5.4 Neither the Owner nor the A/E shall have any obligation to pay or to see to the payment of any moneys to any Subcontractor except as may otherwise be required by law.
- 11.5.5 No Certification for Payment, nor any progress payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute acceptance or approval of any Work not in accordance with the Contract Documents.

11.6 Payments Withheld.

- 11.6.1 The A/E may decline to certify the full payment of the amount requested by the Contractor in his monthly application to the extent necessary to reasonably protect the Owner. If the A/E is unable to certify payment in the amount of the Application, he will, within 10 days after receipt of the monthly application, notify the Contractor in writing the reasons he cannot make such a certification. If the Contractor and the A/E cannot agree on a revised amount within five days of A/E sending written notice, the A/E will promptly issue a Certification for Payment for the amount for which he is able to certify to the Owner pursuant to Sub-Article 11.4.2. The A/E may also decline to certify payment because of subsequently discovered evidence or subsequent observations, he may nullify the whole or any part of any Certification for Payment, to such extent as may be necessary to protect the Owner from loss because of:
 - 11.6.1.1 Defective work not remedied;
 - 11.6.1.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;
 - 11.6.1.3 Failure of the Contractor to make payments properly to subcontractors or for labor,

materials or equipment;

- 11.6.1.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- 11.6.1.5 Damage to the Owner or another contractor;
- 11.6.1.6 Reasonable evidence that the Work will not be completed within the Contract Time;
- 11.6.1.7 Failure to carry out the Work in accordance with the Contract Documents;
- 11.6.1.8 A lien or attachment is filed and such lien is not discharged within 5 days of demand from the Owner;
- 11.6.1.9 Failure of the Contractor and/or of the Mechanical or Electrical Subcontractors to comply with the mandatory requirements for maintaining "up-to-date" Record Drawings;
- 11.6.1.10 Incomplete or otherwise inadequate Application for Payment; or
- 11.6.1.11 Reasonable evidence that the Contractor is in material breach of his obligations under the Contract.
- 11.6.2 When the above grounds in Sub Article 11.6.1 are removed, payment shall be made for amounts withheld because of them.
- 11.7 Substantial Completion.
 - 11.7.1 When the Contractor considers that the Work, or a designated portion thereof which is acceptable to the Owner, is Substantially Complete as defined in Sub Article 10.1.3 the Contractor shall prepare for submission to the A/E and Owner a list of items to be completed or corrected. The failure to include any item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. When the A/E and Owner on the basis of an inspection determines that the Work or designated portion thereof is Substantially Complete, the A/E will then prepare a Certificate of Substantial Completion which shall establish the Date of Substantial Completion, shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities and damage to the Work, and shall fix the time within which 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 of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.
 - 11.7.2 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the A/E, the Owner shall make payment, reflecting adjustment for defective or incomplete work, if any, for such Work or portion thereof, as provided in the Contract Documents. Double the amount necessary to complete the Work shall be retained by the Owner pursuant to SDCL § 5-18B-13.
- 11.8 Final Completion and Final Payment.
 - 11.8.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the A/E and Owner will promptly make such inspection and, when they find the Work acceptable under the Contract Documents and the Contract fully performed, the A/E will promptly issue a final Certificate for payment stating that to the best of his observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in said final Certificate, is due and payable. The A/E's Final Certificate for Payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment as set forth in Sub-Article 11.8.2 have been fulfilled.
 - 11.8.2 The final payment shall not become due until the Contractor submits to the A/E and Owner (1) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or his property might in any way be responsible, have been paid or otherwise satisfied, (2) consent of surety to final payment, (3) if required by the Owner, other data establishing payment or satisfaction of all such obligation, such as receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designated by the Owner, (4) an Unemployment Compensation Contribution Certificate from the South Dakota Department of Labor, and (5) a full and complete release of the Owner from all liability under the Contract and otherwise, except to the extent provided in Sub-

Article 11.8.4. If the Contractor fails to furnish such releases or waivers of liens as the Owner reasonably requires to determine that there are no outstanding liens, the Owner may require that Contractor, as a condition of final payment to furnish a bond satisfactory to the Owner to indemnify the Owner against any such liens. Cost of such bond shall be borne by the Contractor. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

- 11.8.3 Owner shall make final payment of all sums due to the Contractor 30 days after the completion and acceptance of the project by the Owner and Contractor's compliance with Article 11.8.2 above. If the Owner fails to make final payment to the Contractor within the time specified herein, the Owner shall pay the Contractor interest at the rate of four percent (4%) compounded annually on the amount retained starting from the date final payment first becomes due.
- 11.8.4 The acceptance of final payment by the Contractor shall constitute a complete and unconditional waiver and release of any and all claims by the Contractor of whatever nature, and regardless whether they are then known or unknown, and a complete and unconditional release of the Owner and every person for whom the Owner is responsible for any and all matters related to the Contract or otherwise, except those claims which have been made in writing and identified by the Contractor as not having been settled at that time.

Article 12 PROTECTION OF PERSONS AND PROPERTY

- 12.1 Safety Precautions and Programs: The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work, and for safeguarding all adjacent properties and facilities.
- 12.2 Safety of Persons and Property.
 - 12.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:
 - 12.2.1.1 All employees on the Work and all other persons who may be affected thereby;
 - 12.2.1.2 All the Work and all materials and equipment to be incorporated therein, whether in storage or off the site, under the care, custody or control of the Contractor and any of his Subcontractors or Sub-subcontractors; and
 - 12.2.1.3 Other property at the site or adjacent thereto, including but not limited to, work of the Owner or of separate contractors, trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
 - 12.2.2 The Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss, and shall indemnify the Owner and the A/E and save them harmless against all claims, penalties, actions and proceedings relating thereto or the Contractor's failure so to comply.
 - 12.2.3 The Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.
 - 12.2.4 When the use or storage of any hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.
 - 12.2.5 The Contractor shall promptly remedy all damage or loss to any property referred to in Sub-Articles 12.2.1.2 and 12.2.1.3 caused in whole or in part by the Contractor, any Subcontractor, any Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable and for which the Contractor is responsible under Sub-Articles 12.2.1.2 and 12.2.1.3,
except damage or loss attributable to the acts or omissions of the Owner or A/E or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to his obligations under Sub-Article 6.16.

- 12.2.6 The Contractor shall designate a responsible member of his organization at the Site whose duty shall be the prevention of accidents. This person shall be qualified as a safety supervisor by experience, training, or education and shall have the responsibility to insure and enforce safety requirements on behalf of the Contractor and shall be designated by the Contractor in writing to the Owner and the A/E.
- 12.2.7 The Contractor shall issue weekly safety reports to the Owner and the A/E attesting to conditions on the Site relating to safety and to actions taken.
- 12.2.8 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.
- 12.2.9 The structure of the Project is designed to support the loads of the finished building. No provision is included for stresses or loads imposed by construction operations. If the Contractor desires to place such loads in excess of the design load shown on drawings, he shall submit drawings and calculations prepared by, and bearing the seal of a professional structural engineer of the proposed method for supporting such loads for the A/E's review and approval. No loading of any kind in excess of design loads shall be placed on any part of the building structure prior to the A/E's approval of submitted drawings and calculations. The costs of the A/E's review shall be borne by the Contractor.
- 12.2.10 The Contractor shall prepare a written report setting forth the circumstances and details related to any accident or occurrences involving death, bodily injury, sickness, disease, personal injury, and/or loss or injury to or destruction of tangible property. Such reports shall be forwarded promptly to the insurance carriers, the A/E and the Owner.
- 12.3 Emergencies: In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss and shall as promptly as conditions permit notify the insurance carriers, Owner, and A/E of the nature of the emergency and circumstances related thereto. Immediately thereafter, the Contractor shall prepare a written report setting forth in detail the action taken and describing in detail all circumstance and conditions which are related to such action.

Article 13 INSURANCE

- 13.1. At all times during the term of this Agreement, Contractor shall obtain and maintain in force insurance coverage of the types and with the limits as follows:
 - 13.1.1. Commercial General Liability Insurance:

equivalent form of coverage with a limit of not less than one million dollars (\$1,000,000) for each occurrence. If such insurance contains a general aggregate limit it shall apply separately to this Agreement or be no less than two (2) times the occurrence limit. The insurance policy shall name the State of South Dakota, its officers and employees, as additional insureds, but liability coverage is limited to claims not barred by sovereign immunity. The State of South Dakota, its officers and employees do not hereby waive sovereign immunity for discretionary conduct as provided by law.

- 13.1.2. Business Automobile Liability Insurance: Contractor shall maintain business automobile liability insurance or equivalent form with a limit of not less than one million dollars (\$1,000,000) for each accident. This insurance shall include coverage for owned, hired and non-owned vehicles.
- 13.1.3. Worker's Compensation Insurance: Contractor shall procure and maintain workers' compensation and employers' liability insurance as required by South Dakota or Federal law.

13.1.4. Builder's Risk Insurance:

Contractor shall maintain builder's risk insurance with a limit of not less than the full value of this Agreement upon any building, structure, equipment and appliance in the process of construction or installation under state contract and upon all materials on site, until such time as the building, structure, equipment and appliances have been finally accepted by the Owner and the contract completed. This insurance shall include the interest of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Work and shall insure against loss by physical damage including, without duplication of coverage, fire, flood, extended coverage, theft, vandalism, malicious mischief, and collapse.

13.1.5. Installation Floater Insurance:

Contractor shall maintain installation floater insurance with a limit of not less than the full value of Specialized Equipment and Material upon specialized equipment and material not covered under the Builder's Risk Insurance in the process of construction or installation under state contract and upon all materials on site, until such time as the building, structure, equipment and appliances have been finally accepted by the Owner and the contract completed. This insurance shall include the interest of the Owner, Contractor, Subcontractors, and Subsubcontractors in the Work and shall insure against loss by physical damage including, without duplication of coverage, fire, flood, extended coverage, theft, vandalism, malicious mischief, and collapse.

Before beginning work under this Agreement, Contractor shall submit insurance policies to the State Engineer for review and approval, and shall furnish the State with properly executed Certificates of Insurance which shall clearly evidence all insurance required in this Agreement including naming the State, its officers and employees, as additional insureds, as set forth above. In the event of a substantial change in insurance, issuance of a new policy, cancellation or nonrenewal of the policy, Contractor agrees to provide immediate notice to the State and provide a new certificate of insurance showing continuous coverage in the amounts required. Contractor shall furnish copies of any changed or new insurance policies if requested by the State.

Article 14

CHANGES IN THE WORK

- 14.1 Change Orders: A Change Order is a written order to the Contractor signed by the Owner, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum or the Contract Time.
- 14.2 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, the Contract Sum and the Contract Time being adjusted accordingly. All such changes in the Work shall be authorized by Change Order, and shall be performed under the applicable conditions of the Contract Documents. No later than the 5th day of each month, the A/E will process a written change order to include all outstanding RFPs.
- 14.3 The cost or credit to the Owner resulting from a change in the Work shall be determined in one or more of the following ways:
 - 14.3.1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Such lump sum proposals shall be supported by a completely detailed analysis of the proposed change subdivided into the Work of the Contractor and/or the Work of each Subcontractor and/or Sub-subcontractors involved in the proposed change, as applicable, with each such subdivision further broken down into the following elements:
 - 14.3.1.1 Number of man-hours of labor to be performed by each trade, craft or classification of employee involved in the proposed change.
 - 14.3.1.2 The hourly rate for each such trade, craft or classification of employee, including the appropriate wage supplement for social security, old age and unemployment contributions, and such other employee benefits as may be established by statute or by written agreement negotiated by and between organizations representing such crafts or trades and representatives of their employers.

- 14.3.1.3 The estimated quantity of each item or element of material and/or equipment entering into the proposed change.
- 14.3.1.4 The unit cost of each such item or element of material and/or equipment.
- 14.3.1.5 Rental of items or units of construction plant and equipment with a schedule of the period or periods of use of such item or unit in connection with the proposed change.
- 14.3.1.6 Rental terms and rates for each such item or unit of construction plant and equipment. Rental for equipment shall be based on the following:
 - 14.3.1.6.1 Hourly rental rates shall be based on 80% of the applicable rates for equipment listed in the 'Green Book', latest edition, (published by the Associated Equipment Distributors, 615 West 22nd Street, Oakbrook, Illinois, 60523).
 - 14.3.1.6.2 Hourly rental rates for equipment not listed in the 'Green Book' shall be based on 100% of the applicable rates for equipment listed in the 'Blue Book', latest edition (published by Dataquest, 1290 Ridder Park Drive, San Jose, California, 95131).
 - 14.3.1.6.3 Hourly rental rates determined from the 'Green Book' or 'Blue Book' includes all items of cost and expense to the Contractor, including gas, oil, maintenance, repairs, insurance, and transportation to and from construction site.
- 14.3.1.7 Power and/or other utilities entering into the proposed change.
- 14.3.1.8 Rates and terms applicable to such power and/or other utilities.
- 14.3.1.9 Additional premiums, if applicable, for the extension of insurance and bond coverages as required herein to the proposed change.
- 14.3.1.10 Applicable federal, state and local taxes.
- 14.3.1.11 Indirect Cost and Fee computed as a percentage override applied to net cost in accordance with the provisions of this Article.
- 14.3.2 By unit prices stated in the Contract Documents or subsequently agreed upon;
- 14.3.3 By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee;
- 14.3.4 By the method provided in Sub-Article 14.3.12.
- 14.3.5 The Contractor shall require that the itemized analysis of each portion of the proposed change to be performed by a Subcontractor and/or Sub-subcontractor be prepared by each such Subcontractor and/or Sub-subcontractor in accordance with the format established herein. Copies of all such itemized analysis shall be appended to the Contractor's itemized analysis of the proposed change in the Work.
- 14.3.6 For purposes of calculating Indirect Cost and Fee in relation to Change Orders, the net cost of a proposed change in the Work shall include, and unless otherwise agreed in writing prior to the performance of the proposed change, shall be limited to the fair and reasonable estimated cost of the total of all of the individual items, elements, or components involved in proposed change in the Work (including adds and deducts) as set forth in Sub-Articles 14.3.1.1 through 14.3.1.8.
- 14.3.7 For each portion of a proposed net additive change in the Work to be performed directly by the Contractor, the cost to Owner shall include an increment for the Indirect Cost and Fee of the Contractor associated with such portion of proposed change of 8% of the net cost of the Work.
- 14.3.8 For each portion of a proposed net additive change in the Work to be performed directly by a Subcontractor, in addition to an increment or increments for Subcontractor's Indirect Cost and profit

associated therewith of 8%, the cost to the Owner shall include a supplementary increment or increments for Contractor's Indirect Cost and Fee associated therewith of 6% of the net cost of the Work.

- 14.3.9 In computing Indirect Cost and Fee, the percentage for Indirect Cost and Fee shall be taken on basic wage only. No percentage override shall be taken on Social Security, Old Age and Unemployment contributions, contributions to Industry funds, education, and Training Funds and/or similar wage supplements, contributions or benefits.
- 14.3.10 Items, elements or components of changes in the Work or proposed changes which shall be classified as Indirect Cost and excluded from net cost shall include, but shall not necessarily be limited to:
 - 14.3.10.1 All classifications of administrative, supervisory, and clerical personnel not engaged manually in the performance of the Work, including timekeepers, clerks, watchmen, and security personnel.
 - 14.3.10.2 Miscellaneous expense, job burden, and/or other generalized categories of cost or expense.
 - 14.3.10.3 Use of small tools and miscellaneous materials.
 - 14.3.10.4 Insurance other than insurance coverage required herein.
- 14.3.11 In changes in the Work involving both additions to and deductions in the Work, or any portion or element thereof, or the relocation or rearrangement of items, portions or elements thereof, or the substitution of any items, portions or elements thereof, such additions and deductions shall be balanced, and the Contractor's Fee computed on the same basis for deductions as well as additions. If at the request of the A/E and/or the Owner a number of unrelated changes in the Work are set forth individually, summarized and totaled in a single Change Order for reasons of administrative convenience, the amount or amounts of individual deductive changes in the Work set forth therein shall, in any event, be balanced against the amount or amounts of individual additive changes in computing the Contractor's Fee for the purpose of adding and deducting.
- 14.3.12 If none of the methods set forth in Sub-Articles 14.3.1, .3.2 or .3.3 is agreed upon, the Contractor, provided he receives a written order signed by the Owner, shall promptly proceed with the Work involved. The cost of such Work shall then be determined by the Owner on the basis of the reasonable expenditures and savings of those performing the Work attributable to the change, including, in the case of an increase in the Contract Sum, a reasonable allowance for the Contractor's Fee. In such case, and also under Sub-Articles 14.3.3 and .3.4 above, the Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting together with appropriate supporting data for inclusion in a Change Order, at the end of each day, and will submit to the Owner or his designated representative: (a) daily time slips showing the name of each workman employed on such work, the number of hours which he is employed thereon, the character of his duties, and the wages and benefits to be paid to him and on his behalf, and (b) a memorandum of the equipment used in the performance of such Work, together with the rental claimed therefor. Unless otherwise provided in the Contract Documents, cost shall be limited to the following: cost of materials, including sales tax and cost of delivery; cost of labor, including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; worker's or workmen's compensation insurance; bond premiums; rental value of equipment and machinery; and the additional costs of supervision and field office personnel directly attributable to the change. Pending final determination of cost to the Owner, payments on account shall be made on the basis of amounts reasonably estimated by the Owner. The amount of credit to be allowed by the Contractor to the Owner for any deletion or change which results in a net decrease in the Contract sum will be the amount of the actual net cost as confirmed by the A/E and agreed to by the Owner. When both additions and credits covering related Work or substitutions are involved in any one change, the allowance or credit for the Contractor's Fee shall be figured on the basis of the net increase, or decrease, if any, with respect to that change.

14.4 Differing Site Conditions

14.4.1 The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the A/E of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

- 14.4.2 The A/E shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, the Contract Sum shall be adjusted as provided in this Article, provided that the work has been ordered in writing by Owner and A/E as provided in Sub-Article 14.1 above. There shall be included in the adjustment to the Contract Sum under the preceding sentence a reasonable allowance for any extraordinary increase in Indirect Cost borne by the Contractor because of such additional work.
- 14.5 Claims for Additional Cost.
 - 14.5.1 If the Contractor wishes to make a claim for an increase in the Contract Sum, he shall give the A/E and Owner a written notice thereof within 10 days after the occurrence of the event giving rise to such claim except where claim is made in connection with deviations in Shop Drawing or Sample submittals, in which case claim shall be made in writing to the A/E concurrently with such submittals. This notice shall be given by the Contractor before proceeding to execute the work, except in an emergency endangering life or property in which case the Contractor shall proceed in accordance with Sub-Article 12.3. No such claim shall be valid unless so made. Any change in the Contract Sum resulting from such claim shall be authorized by Change Order.
 - 14.5.2 If the Contractor claims that additional cost is involved because of, but not limited to, (1) any written interpretation pursuant to Sub-Article 4.13, (2) any order by the Owner to stop the Work pursuant to Sub-Article 5.2 where the Contractor was not at fault, (3) any written order for a minor change in the Work issued pursuant to Sub-Article 14.6, or (4) any deviation in Shop Drawing or Sample submittals from the requirements of the Contract Documents, the Contractor shall make such claim as provided in Sub-Article 14.5.1.
- 14.6 Minor Changes in the Work: The A/E will have authority to order minor changes in the Work not involving an adjustment in the Contact Sum or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order, and shall be binding on the Owner and the Contractor. The Contractor shall carry out such written orders promptly.

Article 15 UNCOVERING AND CORRECTION OF WORK

15.1 Uncovering of Work.

- 15.1.1 If any portion of the Work should be covered contrary to the request of the A/E or the Owner, or the requirements specifically expressed in the Contract Documents, it must, if required in writing by the A/E or the Owner, be uncovered for his observation and shall be replaced at the Contractor's expense.
- 15.1.2 If any other portion of the Work has been covered which the A/E or the Owner has not specifically required to observe prior to being covered, the A/E or the Owner may request to see such Work and it shall be uncovered by the Contractor. If such work be found in accordance with the Construction Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such work be found not in accordance with the Construction Documents, the costs unless it be found that this condition was caused by the Owner or a separate contractor as provided in Article 8, in which event the Owner shall be responsible for the payment of such costs.

15.2 Correction of Work.

- 15.2.1 The Contractor shall promptly correct all Work rejected by the A/E as defective or as failing to conform to the Construction Documents whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work, including compensation for the A/E's additional services and the Office of the State Engineer fees made necessary thereby.
- 15.2.2 If, at any time after the Owner's acceptance of the fully completed Project any of the Work is found not to have been provided in conformance with the Construction Documents, or, if within one year after such acceptance any of the Work is otherwise found to be faulty or defective, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so. The Contractor shall also repair or

replace any part of the Work which is damaged by the defective condition or the remedial Work. This obligation shall survive termination of the Contract, subject to the terms of any applicable statute of limitations. The Owner shall give such notice promptly after discovery of the condition.

- 15.2.3 The Contractor shall remove from the Site all portions of the Work which are defective or non- conforming and which have not been corrected under Sub-Articles 6.4.1, 15.2.1 and 15.2.2, unless removal is waived by the Owner.
- 15.2.4 If the Contractor fails to correct defective or non-conforming Work as provided in Sub-Articles 6.4.1, 15.2.1 and 15.2.2, the Owner may correct it in accordance with Sub-Article 5.3.
- 15.2.5 If the Contractor does not proceed with the correction of such defective or non-conforming Work within a reasonable time fixed by written notice from the A/E, the Owner may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within 10 days thereafter, the Owner may upon 10 additional days written notice sell such Work at auction or a private sale and shall account for the net proceeds thereof, after deducting all the costs that should have been borne by the Contractor, including compensation for the A/E's additional services made necessary thereby. If such proceeds of sale do not cover all costs which the Contractor should have borne, the difference shall be charged to the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner upon demand.
- 15.2.6 The Contractor shall bear the cost of making good all work of the Owner or separate contractors destroyed or damaged by such correction removal.
- 15.2.7 Nothing contained in this Article shall be construed to establish a period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents, including Sub-Article 6.4 hereof. The establishment of any time period prescribed by the terms of any warranty required by the Contract Documents relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor the time within which proceedings may be commenced to establish the Contractor liability with respect to his obligations other than specifically to correct the Work.
- 15.3 Acceptance of Defective or Non-Conforming Work: If the Owner prefers to accept defective or non- conforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect a reduction in the Contract Sum where appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

Article 16 TERMINATION OF THE CONTRACT

- 16.1 Termination by the Contractor: If the Work is stopped for a period of 90 days under an order of any court or any public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of the Contractor or Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, then the Contractor may, upon 7 additional days written notice to the Owner and the A/E, terminate the Contract and recover from the Owner payment for all Work executed to the termination date, together with reasonable demobilization costs. The Contractor shall have no other right to terminate the Contract for any reason.
- 16.2 Termination by the Owner.
 - 16.2.1 If the Contractor is in default under the Contract Documents, the Owner may, without prejudice to any other right or remedy and upon written notice to the Contractor, terminate the contract.

Prior to termination of the Contract, the Owner shall give the Contractor and his surety 10 calendar days written notice, during which the Contractor and/or his surety may rectify the cause of the termination. If rectified to the satisfaction of the Owner within said 10 days, the Owner may rescind its notice of termination. If not rectified, the termination for cause shall become effective at the end of the 10 day

notice period. In the alternative, the Owner may postpone the effective date of the termination notice, at its sole discretion, if it should receive reassurances from the Contractor and its surety that the causes of termination will be remedied in a time and manner which the Owner finds acceptable. If at any time more than 10 days after the notice of termination, the Owner determines that the Contractor or its surety has not or is not likely to rectify the causes of termination in an acceptable manner or within the time allowed, then the Owner may immediately terminate the Contract for cause by giving written notice to the Contractor and its surety. In no event shall termination for cause terminate the obligations of the Contractor's surety on its payment and performance bonds.

Notice of termination, whether initial or given after a period of postponement, may be served upon the Contractor and the surety by mail or any other means at their last known places of business in South Dakota or elsewhere, by delivery to any officer or management/supervisory employee of either wherever they may be found, or, if no such officer, employee or place of business is known or can be found by reasonable inquiry within 3 days, by posting the notice at the job site. Failure to accept or pick up registered or certified mail addressed to the last known address shall be deemed to be delivery.

Upon termination of the Contract, the Owner shall take possession of the premises and of all materials, tools, appliances, equipment, and other facilities on the Project, wherever stored, and may finish the Work by whatever method he may deem expedient. The Contractor shall assign Subcontracts to the Owner or to a designated substitute contractor promptly upon request. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished and the Owner has determined its damages owing to the Contractor's default.

- 16.2.2 If the costs of finishing the Work, including compensation for the A/E's and Office of the State Engineer's additional services made necessary by the Contractor's default, and all other damages suffered by the Owner on account of the Contractor's default, exceed the unpaid balance of the Contract Sum, the Contractor shall pay the difference to the Owner, and this obligation for payment shall survive the termination of the Contract. If the costs of finishing the Work are less than the unpaid portion of the contractor for all Work executed to the date of termination, less actual damages. The Owner will not be obligated to pay any further amount on account of Direct Cost, Indirect Cost or Fee.
- 16.2.3 If it should be judicially determined that the Owner improperly terminated this Contract for cause, then the termination shall be deemed to be a termination for the convenience of the Owner.
- 16.3 Termination for Convenience.
 - 16.3.1 The Owner may terminate this Contract at any time without cause, in whole or in part, upon giving the Contractor notice of such termination. Upon such termination, the Contractor shall immediately cease Work and remove from the project site all of its labor forces and such of its materials as Owner elects not to purchase or to assume in the manner hereinafter provided. Upon such termination, the Contractor shall take such steps as Owner may require to assign to the Owner the Contractor's interest in all Subcontracts and purchase orders designated by Owner. After all such steps have been taken to Owner's satisfaction, the Contractor shall receive as full compensation for termination and assignment the following:
 - (1) All amounts then otherwise due under the terms of this Contract,
 - (2) Amounts due for work performed subsequent to the latest Request for Payment through the date of termination,
 - (3) Reasonable compensation for the actual cost of demobilization incurred by the Contractor as a direct result of such termination. The Contractor shall not be entitled to any compensation for lost profits or for any other type of contractual compensation or damage other than those provided by the preceding sentence. Upon payment of the foregoing, Owner shall have no further obligations to Contractor of any nature.
 - 16.3.2 In no event shall termination for the convenience of the Owner terminate the obligations of the Contractor's surety on its payment and performance bonds.

00 01 07 PROFESSIONAL SEALS

PART 1 – GENERAL

- 1.1 Professional Certifications
 - A. Architect of Record
 - 1. TSP, Inc.
 - 2. 600 Kansas City Street
 - 3. Rapid City, SD 57701
 - 4. Phone No. 605-343-6102
 - 5. Bradley Ryan Mitzelfelt
 - 6. License No. 15208
 - B. Structural Engineer of Record
 - 1. TSP, Inc.
 - 2. 600 Kansas City Street
 - 3. Rapid City, SD 57701
 - 4. Phone No. 605-343-6102
 - 5. Alex R. Weiers
 - 6. License No. 11332
 - C. Mechanical Engineer of Record
 - 1. TSP, Inc.
 - 2. 600 Kansas City Street
 - 3. Rapid City, SD 57701
 - 4. Phone No. 605-343-6102
 - 5. Chris H. Maks
 - 6. License No. 14612
 - D. Electrical Engineer of Record
 - 1. TSP, Inc.
 - 2. 600 Kansas City Street
 - 3. Rapid City, SD 57701
 - 4. Phone No. 605-343-6102
 - 5. Jacob J. Fleck
 - 6. License No. 16509
 - E. Civil Engineer of Record
 - 1. FMG Engineering
 - 2. 3700 Sturgis Road
 - 3. Rapid City, SD 57702
 - 4. Phone No. 605-342-4105
 - 5. Jason A. Pettyjohn
 - 6. License No. 9992

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END SECTION 00 01 07

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SECTION 00 01 10 INDEX OF TECHNICAL SPECIFICATIONS

PART 1 – GENERAL

1.1 Technical Specifications

Α.	The specification sections listed below form a part of the contract.			
	Section No.	Title		
	00 01 10	Index of Technical Specifications		
	00 01 15	List of Drawing Sheets		
	00 60 00	Project Forms		
	00 63 13	Request for Information/Instruction (RFI) Form		
	00 63 14	Supplemental Instruction (SI) Form		
	00 63 54	Request for Proposal (RFP) Form		
	00 63 60	CCO Proposal Spreadsheet Form		
	00 63 63	Construction Change Order (CCO) Form		
	00 65 16	Certificate of Substantial Completion		
	00 65 19	Certificate of Completion		
	00 65 20	Lien Release Form		
	00 65 21	Lien Release Tracking Form		
	00 73 00	Supplementary Conditions		
	00 73 63	Security Requirements		
	01 01 00	General		
	01 14 00	Work Restrictions		
	01 18 00	Project Utilities		
	01 30 00	Electronic Submittal Procedures		
	01 32 16	Project Schedules		
	01 33 00	Submittal Procedures		
	01 33 23	Shop Drawings Product Data and Samples		
	01 33 29	Sustainability Requirements and Reporting		
	01 35 26	Safety Requirements		
	01 35 30	Security Requirements		
	01 42 00	Sources for Reference Publications		
	01 45 00	Quality Control		
	01 45 29	Testing Laboratory Services		
	01 50 00	Temporary Facilities		
	01 57 19	Temporary Environmental Controls		
	01 74 19	Construction Waste Management		
	01 74 20	Waste and Recycling Tracking Form		
	01 76 00	Protecting Installed Construction		
	01 78 00	Closeout Submittals		
	01 78 23	Operation & Maintenance Data		
	01 78 24	Facility Data Requirements		
	02 21 13	Site Surveys		
	02 41 19	Selective Demolition		
	03 30 00	Cast In Place Concrete		
	04 01 20.63	Brick Masonry Repair		
	04 01 20.64	Brick Masonry Repointing		
	04 43 13.16	Adhered Brick Masonry Veneer		
	04 72 00	Cast Stone Masonry		
	05 50 00	Metal Fabrications		
	06 10 00	Rough Carpentry		
	06 15 33	Wood Patio Decking		
	06 16 00	Sheathing		
	06 20 23	Interior Finish Carpentry		
	06 41 13	Wood-Veneer-Faced Architectural Cabinets		
	06 43 00	Wood Stairs and Railings		
	07 21 00	Thermal Insulation		
	07 25 00	Weather Barriers		

07 31 13	Asphalt Shingles
07 41 00	Sealants Roofing
07 60 00	Flashing & Sheet Metal
07 84 00	Fire Stopping
07 92 00	Joint Sealants
08 11 13	Steel Doors & Frames
08 14 16	Flush Wood Doors
08 31 13	Access Doors and Frames
08 71 00	Door Hardware
09 29 00	Gypsum Board
09 30 13	Ceramic Tiling
09 65 13	Resilient Base and Accessories
09 65 19	Resilient Tile Flooring (LVT)
09 68 13	Carpet Tile
09 91 23	Interior Painting and Coatings
09 93 00	Staining and Transparent Finishing
10 28 00	Toilet Bath and Laundry Accessories
10 44 13	Fire Extinguisher Cabinets
12 21 13	Horizontal Louver Blinds
12 36 61.16	Solid Surfacing Countertops
21 05 00	Common Work Results for Fire Suppression
21 05 53	Identification for Fire Suppression Piping and Equipment
21 13 13	Wet-Pipe Sprinkler Systems
22 05 00	Common Work Results for Plumbing
22 05 19	Meters and Gages for Plumbing Piping
22 05 23	General Duty Valves for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 11 16	Domestic Water Piping
22 11 19	Domestic Water Piping Specialties
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties
22 33 00	Water Heaters
22 40 00	Plumbing Fixtures
23 05 00	Common Work Results for HVAC
23 05 13	Common Motor Requirements for HVAC Equipment
23 05 53	Identification for HVAC Piping, Ductwork, and Equipment
23 05 93	Testing, Adjusting, and Balancing HVAC
23 07 13	Duct Insulation
23 11 20	Facility Gas Piping
23 31 13	Metal Ducts
23 33 00	Air Duct Accessories
23 34 16	Centrifugal HVAC Fans
23 37 13	Diffusers, Registers, and Grilles
23 54 00	Furnaces
26 05 00	Common Work Results for Electrical
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73	Short Circuit Study Only
26 24 16	Panel Boards
26 27 26	Wiring Devices
26 28 16	Enclosed Switches and Circuit Breakers
26 51 00	Interior Lighting
26 56 00	Exterior Lighting

27 15 00	Communications Horizontal Cabling
28 31 11	Digital Addressable Fire Alarm System
31 10 00	Civil Engineering Site Work Demolition
31 20 00	Earthwork
32 16 23	Portland Cement Concrete Sidewalks and Concrete Sitework
32 92 00	Turf and Grasses

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION - NOT USED

END SECTION 00 01 00

00 01 15 LIST OF DRAWINGS

PART 1 - GENERAL

1.2

1.1 SUMMARY This section lists the drawings for the project.

PROJECT DRAWINGS	
<u>Sheet No.</u>	<u>Title</u>
G-001	Cover Sheet
G-101	Life Safety Plan
C-101	Site and Utility Plan
C-102	Grading Plan
C-103	Site Profiles
C-104	Erosion Control & Landscaping Plan
C-105	Site Details
S-001	Structural General Notes & Title Sheet
S-101	Existing Foundation, Floor Framing, & Roof Framing Plans
S-102	Foundation Plan
S-103	Floor Framing Plan
S-104	Roof Framing Plan
S-501	Structural Details
AD101	Demolition Floor Plans
	Reflected Ceiling Demolition Plans
AP101	First Level Floor Plan
ΔΡ102	Lower Level Floor Plan
AC101	First Level Reflected Ceiling Plan
AC102	Lower Level Reflected Ceiling Plan
AE102	Finish Floor Plan and Schedules
Δ-301	Stair and Deck Details
Δ-401	Interior Elevations
Δ-402	Interior Elevations
11 402	
M-001	Mechanical Title Sheet
FP101	Fire Protection Plans
PD101	Plumbing Demolition Plans
PL101	Plumbing Plans – New Construction
MD101	Mechanical Demolition Plans
MH101	Mechanical HVAC Plans – New Construction
M-401	Enlarged Mechanical Plans
M-501	Mechanical Details
ME601	Mechanical Schedules
E 001	Electrical Abbraviations, Symbols, and Canaral Natas
	Electrical Appreviations, Sympols, and General Notes
	Electrical Demonition Plan
	Lighting Plans
	Power and Technology Plans
E-001	Electrical Riser and Schedules

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END SECTION 00 01 15

00 60 00 PROJECT FORMS

PART 1 – GENERAL

- 1.1 GENERAL
 - A. This section outlines required documentation to be provided to the AE and Owner at the beginning of the project.

1.2 PRE-CONSTRUCTION PROJECT SUBMITTALS

The following submittals are required prior to or at the Pre-Construction meeting:

- A. Agreement for Construction:
 - 1. Contractor shall make a copy for their records, sign, and return the original contract to the SD Dept. of the Military within 10 days of transmittal.
- B. Performance and Payment Bond:
 - 1. Contractor shall submit a Performance and Payment Bond within five (5) calendar days after submittal of the signed contract.
 - 2. Performance and Payment Bond must be reviewed and approved by the South Dakota Attorney General's Office prior to issuance of the Notice to Proceed.
 - a. Contractor will be required to submit revised Performance and Payment Bonds if errors are found during review process.
- C. Certificate of Insurance
 - 1. Certificate must list "South Dakota Department of the Military" as an additionally insured party.
- D. Contractor's Statement of Skills and Capabilities
 - 1. Contractor shall have a current year's statement on file with the SD Dept. of the Military.
- E. Contractor's Affirmative Action Plan
 - 1. Contractor's with fifteen (15) or more employees must provide AAP
 - 2. Contractors with fewer than fifteen (15) employees shall provide a formal letter stating number of employees and exemption form this requirement
- F. Contractor's Letter indicating they are not Debarred or Suspended
- G. Contractor's and Subcontractor's Statement of Experience & Qualifications per various Technical Specification requirements.
- H. Contractor's Material Supplier's Statement of Experience & Qualifications per various Technical Specification requirements.
- I. List of Subcontractors and Material Suppliers (AIA G805)
- J. Schedule of Values (AIA G702 & G703)

1.4 POST NOTICE TO PROCEED SUBMITTALS

The following submittals are required within 10 calendar days from issuance from the Notice to Proceed:

- A. Project Progress Schedule
 - 1. Refer to section 01 32 16 Project Schedule for requirements.
- B. Draft Real Property Data Form 1354
 - 1. Refer to section 01 32 16 Project Schedule for requirements.
- C. Accident Prevention Plan
 - 1. Refer to section 01 35 26 Safety Requirements for requirements.
- D. No Smoking Policy
 - 1. Refer to section 01 14 00 Work Restrictions.
- E. Construction Waste Management Plan
 - 1. Refer to section 01 74 19 Construction Waste Management.
- F. Environmental Protection Plan
 - 1. Contractor must submit within 10 days from NTP.
 - 2. Refer to section 01 57 19 Erosion and Sediment Controls
- G. Notice of Intent (NOI)
 - 1. Contractor must submit a copy of the SD DANR NOI within 10 days from NTP.
 - 2. Refer to section 01 57 19 Erosion and Sediment Controls.
- H. Employee Access Lists (EAL) for Contractor and all Subcontractors and Suppliers
 - 1. EAL's shall be submitted to the SD Dept. of the Military prior to or at the Pre-Construction Meeting.
 - 2. Background checks take a minimum of 10 days to process.
 - 3. No work may begin until the Contractor's designated supervisors have passed a background check.

- 4. No additional days will be granted to the Contractor for delays resulting in the Contractor's delayed submittal or in ability to provide personnel that can pass a background check.
- 5. Refer to section 01 35 30 Safety Requirements for requirements.

1.4 ADDITIONAL POST AWARD SUBMITTALS

- A. Shop Drawings
 - 1. Submit to AE for review and approval
 - 2. Owner shall be copied on all submittals
 - 3. Refer to section 01 33 23 Shop Drawings Product Data and Samples for requirements.
- B. First Application for Payment
 - a. Shall be submitted within 30 days of the NTP
- C. Monthly Progress Payments
- D. Lien Waivers
 - 1. Contractor shall include Lien Waivers signed by Sub-Contractors and Suppliers included with Monthly Progress Payments for projects \$250,000 or more.
- E. RFI'S
- F. RFP'S
- G. CCO'S
- H. Inspection, test, and other periodic reports as required in various Technical Specifications.

PART 2 – PRODUCTS

- 2.1 FACILITY PROPERTY BREAKDOWN:
 - A. The South Dakota Department of the Military is required to identify certain disposed or new assets along with associated costs of said assets.
 - B. The South Dakota Department of the Military will provide a Form 1354 to track all new assets, associated quantities, and associated overall cost of each asset.
 - C. Within 10 calendar days of Notice to Proceed, the Contractor shall submit the estimated quantity and the cost of each on the provided form as accurately as possible.

2.2 BUILDER DATA COLLECTION

- A. Contractor shall provide photographs, equipment name plate data (make, model, serial number, etc.), type, size, and quantity of each for all of the following installed assets:
 - 1. Building Envelope
 - a. Windows
 - b. Solar Tubes
 - c. Store Front Doors
 - d. Doors
 - e. Roofing
 - 2. Electrical
 - a. Exterior Light Fixtures
 - b. Light Poles
 - c. Interior Light Fixtures
 - d. Electric Panels
 - e. Lightning Protection
 - f. Solar Panels
 - g. Standby Generators
 - h. Transfer Switches (Automatic & Manual)
 - i. Transformers (privately owned, not utility owned)
 - 3. Fire Protection
 - a. Fire Alarm Control Panel(s)
 - b. Fire Alarm Annunciator Panel
 - c. Fire Alarm Pull Station
 - d. Fire Alarm Strobe/Speaker
 - e. Fire Alarm Detectors
 - f. Mechanical Door Release
 - g. Fire Suppression System Riser
 - h. Fire Suppression Piping

- i. Fire Suppression Heads
- j. Dry System Air Compressor
- 4. Mechanical Systems
 - a. HVAC Equipment
 - b. All Pumps
 - c. Water Heaters
 - d. Passive Solar Wall
 - e. Geothermal System
 - f. In Floor Heating Manifolds and Piping
 - g. Plumbing
 - h. Water Closet/Toilet
 - i. Urinal
 - j. Tub/Shower/Combo
 - k. Restroom Sinks
 - I. Kitchen Sinks
 - m. Map Basin
 - n. Service Sink
 - o. Emergency Shower
 - p. Emergency Eyewash
 - q. Drinking Fountain
 - r. Floor Drains
 - s. Trench Drains
 - t. Roof Drains
 - u. Gas Detection Systems
 - v. Landscape Irrigation System
- 5. Equipment
 - a. Dock Leveler
 - b. Pneumatic Tube System
 - c. Air Compressor
 - d. Pressure Washer
- B. BUILDER Data collection will be required throughout the project with final documentation provided prior to or at the Substantial Completion Inspection.

PART 3 – EXECUTION – Not Used

END 00 60 00

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00 63 13 REQUEST FOR INFORMATION/INSTRUCTION (RFI)

RFI NO	_		
Project Name:			
Project No.			
Date of RFI Submittal:		-	
Date Response Needed by:		-	

SUBJECT:

Description Issue/Item of Concern

Contractor's Project Manager:

Name Printed

Contractor's Project Manager:

Signature

1

00 63 14 SUPPLEMENTAL INSTRUCTION (SI)

Supplemental In	nstruction No.	
Response to RFI	No(s).	
Date of RFI Subn	nittal:	
Project Name:		
Project No.		

Description Issue/Item of Concern

AE/SD DOM Project Manager:

Name Printed

AE/SD DOM Project Manager:

Signature

00 63 54 REQUEST FOR PROPOSAL (RFP)

Request for Prop	osal No		
Date:			
Project Name: Project No.			
riojectivo.			
Please submit an proposed modific	itemized cost breakdown for change cation(s) to the Contract Documents,	es in contract sum and contract time result , within ten (10) calendar days or less :	ing from the following
Proposed Modifi	cation(s):		
RFI # <mark>X</mark> - Please pr	ovide a cost to (Description of scope	of work)	
		The total amount requested for RFI#X is:	\$
RFI # <mark>X</mark> - Please pr	ovide a cost to (Description of scope	of work)	
		The total amount requested for RFI#X is:	\$
RFI # <mark>X</mark> - Please pr	ovide a cost to (Description of scope	of work)	
		The total amount requested for RFI#X is:	\$
	т	he total amount requested for all RFI's is:	\$
Number of addit Indicate the num above. If no chan	ional working days requested are ber of additional working days which ge in contract time, state "none".	 n will be required to complete the scope of	work in all RFI's indicated
Enclosure(s):	Itemized Cost Proposal(s) Shop Drawings		
Contractor's Rep	resentative:N	ame Printed	
Contractor's Rep	resentative:	Signature	

00 63 60 CONSTRUCTION CHANGE ORDER PROPOSAL WORKSHEET

RFP No.	
Date:	
Project Name:	
Project No.	

Item Description	%	General	Sub	
Subcontractor Work				
	7			
Conoral Contractor Work	1			
	ר			
General Contractor Total:		\$0.00		
Prime OH & Profit - General Contractor Only:	8.00%	\$0.00		
Subcontractor Total:			\$0.00	
Prime OH & Profit on Subcontractors:	6.00%	\$0.00		Net Cost
Total:		\$0.00	\$0.00	\$0.00
Bond:	1.00%			\$0.00
Builder's Risk:	0.21%			\$0.00
Contractor Excise Tax:	2.04%			\$0.00
		Net P	Proposed Cost:	\$0.00

** Cost breakdowns and quotes are attached hereto

NOTE to Prime Contractor: Attach proposals from all Subcontractors when submitting to the Architect/Engineer for approval. Must be a complete, itemized breakdown of all labor and material similar to that shown above. Subcontractor sales tax can either be charged by the Sub or the Prime, but not both.

00 63 63 CONSTRUCTION CHANGE ORDER

You are hereby authorized and directed to make the changes to your contract with the State of South Dakota covering the above project, as described below.

Request for Proposal #X

 Description of Work

 Output

 Owner Directed:
 Add/Deduct \$x,xxx.xx

 Add/Deduct \$x,xxx.xx

Request for Proposal #X

•

Description of WorkoUnforeseen Conditions:Add/Deduct \$x,xxx.xxOwner Directed:Add/Deduct \$x,xxx.xx

ċ

Additional Contract Days and Revised Substantial Completion Date:

Additional Contract Days and Revised Final Completion Date:

For labor, material and any other necessary costs to make the change or for omitting labor and material and any other costs, you will be allowed the additions or deductions to the amount of your contact as follows:

ORIGINAL CONTRACT AMOUNT CONTRACT AMOUNT TO DATE ADDITION TO CONTRACT DEDUCTION FROM CONTRACT NET CHANGE TO CONTRACT NET CONTRACT AMOUNT

ېې	<u> </u>
\$ <u> </u>	xx,xxx.xx
\$	XX,XXX.XX

It is hereby understood that the provisions of the contract will not be otherwise changed or affected by this order.

RECOMMENDED BY: STATE OF SOUTH DAKOTA DEPARTMENT OF THE MILITARY DEPARTMENT OF THE MILITARY **CULLEN B. JORGENSEN** (Date) MARK R. MORRELL (Date) **Engineering Manager** Maj Gen (SD), SDNG The Adjutant General ACCEPTED BY: CONSTRUCTION COMPANY NAME (Date) Title

1

Total: +/-\$XX,XXX.XX

Total: +/-\$XX,XXX.XX

of Days OR "0" - SC Date

of Days OR "0" - Final Comp. Date

00 65 16 CERTIFICATE OF SUBSTANTIAL COMPLETION FORM

Project: Project No.: Contractor: Architect/Engineer: Owner: South Dakota Department of the Military

This [preliminary][final] Certificate of Substantial Completion applies to:

All Work

The following specified portions of the Work

DATE

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows:

Amendments to Owner's responsibilities:		None As follows:
Amendments to Contractor's responsibilities:		None As follows:

The following documents are attached to and made a part of this Certificate: ______ Punch List dated xx/xx/xxxx.

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

Contractor	Representative	Date
Architect/Engineer	Representative	Date
<u>South Dakota Department of the Mi</u> Owner	litary Engineering Manager	Date
00 65 16 – CERTIFICATE OF SUBSTANTIAL COM	APLETION FORM 1	October 202

00 65 19 CERTIFICATE OF COMPLETION FORM

Project: Project No.: Contractor: Architect/Engineer: Owner: South Dakota Department of the Military

Scope of work covered by this acceptance is applicable only to the work identified in the substantial completion acceptance form(s) dated: ______.

Date of Completion

FINAL COMPLETION

The work performed under this contract has been inspected and found to be complete. This constitutes the Owner's acceptance for Final Completion for the **ENTIRE** contract amount. The Date of Final Completion of the Project is hereby established as set forth above. In accordance with the General Conditions of the Contract, this is to confirm the results of the Final Completion inspection(s).

The Contractor has completed the list of items identified on the Pre-Final and Final punch list(s) that the inspection team required corrected or completed before final acceptance of the Work in accordance with the General Conditions.

Work accepted with incomplete punch list items or failure of the Owner or other parties to identify Work that does not comply with the Contract Documents or is defective in operation or workmanship does not constitute a waiver of the Owner's rights under the Contract or relieve the Contractor of its responsibility for performance or warranties.

In accordance with the General Conditions, the Date of Final Completion is that Date jointly certified by the Architect/Engineer, Owner, and Contractor that the Work is completed and the Contract is fully satisfied according the Contract Documents. Completion of all Work is a condition Precedent to the Contractor's right to receive Final Payment.

The **CONTRACTOR** has completed/corrected the items identified on all referenced punch list(s) and the requirements of the Contract are fully satisfied according to the Contract Documents.

Contractor

Representative

The **ARCHITECT/ENGINEER** agrees that the Work noted in this Final Acceptance is completed in accordance with the Contract Documents.

Architect/Engineer

Representative

The **OWNER** accepts the Work designated herein to be in accordance with the requirements for Final Completion. Except as provided in the Contract Documents, the South Dakota Department of the Military accepts the Project as complete and accepts responsibility for security, maintenance, and utilities except for Builder's Risk, which is hereby terminated upon the Effective Date of this Acceptance, all other Contractor provided insurance remains in effect through the Warranty period.

South Dakota Department of the Military

Owner

Engineering Manager

Date

Date

Date

2

00 65 20 LIEN WAIVER FORM

The undersigned acknowledges having received payment for materials and labor submitted as subcontract/supplier for:
Sub-Contractor's Pay Application No.:
Dated:
This compensation is full payment for all materials and labor furnished to:
General Contractor:
Project Name:
Project No
Through the period ending: (Date of full payment)
As certified by general/prime contractor payment submitted by:
General Contractor:
General Contractor's Pay Application No.:(Sequential number of General <i>Contractor's pay application)</i>
The undersigned hereby acknowledges and waivers all rights which may have been acquired by the undersigned to file Mechanics Liens against said premises for labor, equipment, and/or materials furnished to said premises prior to the date of progress Application for Payment.
Sub-Contractor's Representative:
Name Printed
Sub-Contractor's Representative:
Date:
Sub-Contractor:
Address:
City, State Zip:
Phone No.
00 65 21 Lien Waiver Tracking Form

Proejct Name Project Number Primer Contractor

Subcontractor/Suppliers	Pay #1	Pay #2	Pay #3	Pay #4	Pay #5	Pay #6	Pay #7	Pay #8	Pay #9	Pay #10	Pay #11	Pay #12

*The first number is the number of the contractor's pay request. The second number is the number of the sub-contractors pay request.

EXAMPLE:

Subcontractor/Suppliers	Pay #											
DJ's Excavating	1-1		3-2	4-3								
Joe's Plumbing	1-1			4-2	5-3							
Snuffy's HVAC		2-1			5-2	6-3						

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00 73 00 SUPPLEMENTARY CONDITIONS

PART 1 – GENERAL

1.1 DESCRIPTION

This section identifies modifications, clarifications, and additions to Section 00 00 07 – General Conditions. The Contractor is responsible for ensuring compliance with all requirements and providing proper documentation to verify and certify such requirements.

1.2 ADDITIONAL PROCUREMENT REQUIREMENTS

A. Build America, Buy America

- The Contractor covenants and agrees that it will comply with The Infrastructure Investment and Jobs Act (IIJA). Pub. L. No. 117-58, which includes the Build America, Buy America Act. Pub. L. No. 117-58, 70901-52. No funds may be obligated to this project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States.
- 2. Additional information may be found at the GSA website, BuyAmerican.gov
- 3. No special waivers will be considered. Only General Applicability Waivers will be accepted as published by the Government.

B. Recycled Content

- 1. The Contractor covenants and agrees that it will use and/or install products composed of the highest percent of recovered material or biobased content practicable, or at least meet, but may exceed, the minimum recovered materials or biobased content of an EPA or USDA designated product.
- 2. Product Supplier Directory for EPA purchasing recommendations related to Recovered Materials Advisory Notice is available at https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program
- 3. USDA designated items are available at <u>http://www.biopreferred.gov</u>

4. Exemptions

- a. Only products identified in the construction documents to be of virgin material.
- b. Should the Contractor encounter difficulties finding products produced in the United States or wishing to use a product not containing recovered material meeting or exceeding the EPA recovered content guidelines, a waiver may be requested.
 - 1) Waivers will require review and approval from National Guard Bureau and will take an extensive period of time for review and approval.
 - 2) Contractor is made aware of this requirement as additional time will not be granted for waiver of noncompliant products.
 - 3) Written justification and documented approval must be included in the shop drawing submittal.

C. Or Equal Clause

Requests for such approval must be consistent with Instructions to Bidders paragraph 8, Article 6.3.4 General Conditions to Agreement of Construction, and must be made in writing to the AE, not later than 10 days prior to the bid opening. This "prior" approval of material or equipment as equal to that specified will be made in writing in the form of an addendum issued by the AE to all plan holders of record. The base bid and any alternate shall be based on materials only as specified or approved.

It is the sole responsibility of the Contractor to document to the satisfaction of the AE that proposed material, item, or piece of equipment is equal or better than that identified on the plans or in the specifications. The requirements of this Article shall be strictly enforced. Failure of the Contractor or Subcontractors to identify and submit in writing requests for approval not later than 10 days prior to the bid opening shall not be just cause for future request for or expectation of acceptance for substitution during the construction period.

1.3 SPECIAL CONTRACT REQUIREMENTS

- A. The Contractor covenants and agrees that it will comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330), as supplemented by Department of Labor regulations (29 CFR Part 5). As applied to this project, the Contract Work Hours and Safety Standards Act specifies that no laborer or mechanic doing any part of the work contemplated by this project shall be required or permitted to work more than 40 hours in any work week unless paid for all additional hours at not less than 1 1/2 times the basic rate of pay.
- B. The Contractor covenants and agrees that it will comply with Executive Order 11246 of September 24, 1965 entitled "Equal Employment Opportunity," as amended by Department of Labor regulations (41 CFR Chapter 60).

- C. The Contractor covenants and agrees that no person shall be denied benefits, or otherwise be subjected to discrimination in connection with the Contractor's performance under this contract, on the grounds of race, religion, color, national origin, gender or handicap. Accordingly, and to the extent applicable, the Contractor covenants and agrees to comply with the following:
 - Title VII of the Civil Rights Act of 1964 (42 U.S.C. § 2000d <u>et seq</u>.), and DoD regulations issued thereunder (32 CFR Part 300);
 - 2. Executive Order 11246 and Department of Labor regulations issued thereunder (41 CFR Part 60);
 - 3. Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794) and DoD regulations issued thereunder (32 CFR Part 56); and
 - 4. The Age Discrimination Act of 1975 (42 U.S.C. § 6101 et seq.) and regulations issued thereunder (45 CFR Part 90).
- D. The Contractor covenants and agrees that it will comply with provisions of the Drug-Free Work Place Act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. § 701 et seq.) and will maintain a drug-free workplace. The Final Rule, Government-Wide Requirements for Drug-Free Workplace (Grants), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28, Subpart f) to implement provisions of the Drug-Free Work Place Act of 1988, is incorporated by reference and the Contractor covenants and agrees to comply with provisions thereof, including amendments to the Final Rule that may hereafter be issued.
- E. The Contractor covenants and agrees that it will comply with the Copeland "Anti-Kickback" Act (18 U.S.C. 874), as supplemented in Department of Labor regulations (29 CFR Part 3). As applied to this project, the Copeland "Anti-Kickback" Act makes it unlawful to induce, by force, intimidation, threat of procuring dismissal from employment, or otherwise, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment.

1.4 DISCREPANCIES, ERRORS AND OMISSIONS

- A. In the event any error, omission or discrepancy in or between drawings and specifications exists or appears to exist, Contractor shall not attempt to profit from such obviously unintentional error, but shall have same explained or adjusted by the AE before submitting their proposal/bid. In the event such clarification is not obtained, the Contractor shall be deemed to have estimated the work as follows:
 - 1. Discrepancies between the drawings and specifications, the specifications shall govern.
 - 2. Discrepancies between the schedule and drawings, the schedules shall govern.
 - 3. Discrepancies between plan drawings and approved shop drawings, the plan drawings shall govern.
 - 4. Discrepancies between drawings, the drawing at the larger scale shall govern.
 - 5. Materials shown on drawings but not described in specifications, the drawings shall govern.
 - 6. Discrepancies between manufacturer's printed installation instructions and the project specifications, the manufacturer's installation instructions shall govern provided the manufacturer's requirements are more stringent than that specified.

1.5 ENGINEERING AND LAYOUT

- A. The Contractor shall provide competent engineering services of layout and execute the work in accordance with the contract requirements. The Contractor shall verify the figures shown on the survey before undertaking any construction work and shall be responsible for the accuracy of the finished work.
- B. The AE has established or will establish such general reference points as will, in his judgment, enable the Contractor to proceed with the work. If the Contractor finds that any previously established reference points have been destroyed or displaced, The Contractor shall promptly notify the AE.
- C. The Contractor shall protect and preserve the established bench marks and monuments and shall make no changes in locations without the written approval of the AE. Any bench marks and monuments which may be lost or destroyed or which required shifting because of necessary changes in grades or locations shall, subject to prior approval by the AE, be replaced and accurately located by the Contractor.

PART 2 – PRODUCTS

PART 3 – EXECUTION

END SECTION 00 73 00

SECTION 00 73 63 SECURITY REQUIREMENTS

PART 1 – GENERAL

1.1 GENERAL

Included in this section are the Contractor's responsibilities to ensure construction sites and SDARNG property remain secure at all times during the construction process.

1.2 SECURITY

- A. Job site security is the responsibility of the Contractor. The Contractor shall take all necessary, prudent, and reasonable actions to secure the project site and the construction limits, including temporary enclosures and storage facilities, against unauthorized entry and theft. An equivalent security level and measures of the adjacent facility shall be maintained.
- B. The Contractor is advised current national "Force Protection Condition" (FPCON) ratings are applicable to all SDARNG facilities statewide. At any time the FPCON level may be increased to a heightened level requiring additional security measures.

Increased security levels may include, but are not limited to, limited personnel access, thorough entry screening of all personnel, random vehicle searches, parking limitations, and other measures may also be enforced. Cooperation with the Dept. of the Military and local SDARNG personnel with respect to FPCON issues is essential and compliance with FPCON measures directed are mandatory for the Prime Contractor, subcontractors, vendors, and suppliers, all employees of those entities, and any other person or persons having business regarding the work of the project who require access to the SDARNG facility.

FPCON measures directed and deemed necessary but which cause delay to the project or which have a negative impact upon the Prime Contractor's abilities to perform the work shall be subject to consideration as Changes in the Work in accordance with Article 14 of the General Conditions to <u>Agreement for Construction</u>.

1.3 FACILITY ACCESS

- A. The Contractor shall submit a SDARNG Contractor Access Application for the individual identified at the Contractor's Superintendent for the project. The Superintendent will be required to pass a background check for unescorted access to the SDARNG project site. The Contractor will be required to have a Superintendent that is able to pass a background check. The Superintendent must be onsite during all time's additional employees or Subcontractors are onsite. The Superintendent is ultimately responsible for all project site security and related issues.
- B. The Contractor shall submit an Employee Access List (EAL) identifying each employee's name and driver's license number or other form of government issued ID number. Only employees on the EAL will be permitted to work on the project site. This list must be kept current throughout the duration of the project. Employees entering the facility may be required to temporarily surrender a government-issued photo ID, such as a driver's license, to verify access clearance.
- C. The Dept. of the Military may, at its sole option, issue to the Contractor one or more proximity cards programmed to allow access to the facility. If such a card(s) is issued, the Contractor shall be responsible to assure only authorized employees utilize the card. The Contractor shall promptly notify the Dept. of the Military in the event the card is lost or damaged in a manner that it cannot be used. The Contractor shall pay \$5.00 for each lost or damaged card. All cards shall be returned to the Dept. of the Military upon completion of the project.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END SECTION 00 73 63

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PART 1 – GENERAL

1.1 PROJECT LOCATION

- A. Facility is located at 2823 W Main Street, Rapid City, SD 57702
- B. Interested bidders should contact the SD Dept. of the Military Project Manager, Kelly Eitreim, at (605) 737-6273 or kelly.eitreim@state.sd.us to make arrangements for access to the facility for site visits.
- C. Pre-bid walk-thru meeting will be held on September 7, 2023 at 10:00 AM MT at the site.

1.2 PROJECT DESCRIPTION

- A. Project Scope of Work Includes:
 - 1. Renovation of General Quarters, Building 250, to accommodate ADA upgrades and new finishes and MEP systems.
- B. Building will be occupied during construction. Contractor shall avoid undue disturbance to building occupants.
- C. Contractor shall not block or obstruct building exits in any way.
- D. Storage areas for materials will be provided within close proximity to the buildings. Exact location will be discussed in greater detail at the preconstruction meeting.

1.3 DISCREPANCIES, ERRORS AND OMISSIONS

- A. In the event any error, omission or discrepancy in or between drawings and specifications exists or appears to exist, Contractor shall not attempt to profit from such obviously unintentional error, but shall have same explained or adjusted by the AE before submitting their proposal/bid. In the event such clarification is not obtained, the Contractor shall be deemed to have estimated the work as follows:
 - 1. Discrepancies between the drawings and specifications, the specifications shall govern.
 - 2. Discrepancies between the schedule and drawings, the schedules shall govern.
 - 3. Discrepancies between plan drawings and approved shop drawings, the plan drawings shall govern.
 - 4. Discrepancies between drawings, the drawing at the larger scale shall govern.
 - 5. Materials shown on drawings but not described in specifications, the drawings shall govern.
 - 6. Discrepancies between manufacturer's printed installation instructions and the project specifications, the manufacturer's installation instructions shall govern provided the manufacturer's requirements are more stringent than that specified.

1.4 ENGINEERING AND LAYOUT

- A. The Contractor shall provide competent engineering services of layout and execute the work in accordance with the contract requirements. The Contractor shall verify the figures shown on the survey before undertaking any construction work and shall be responsible for the accuracy of the finished work.
- B. The AE has established or will establish such general reference points as will, in his judgment, enable the Contractor to proceed with the work. If the Contractor finds that any previously established reference points have been destroyed or displaced, The Contractor shall promptly notify the AE.
- C. The Contractor shall protect and preserve the established bench marks and monuments and shall make no changes in locations without the written approval of the AE. Any bench marks and monuments which may be lost or destroyed or which required shifting because of necessary changes in grades or locations shall, subject to prior approval by the AE, be replaced and accurately located by the Contractor.

1.5 OR EQUAL CLAUSE

Requests for such approval must be consistent with Instructions to Bidders paragraph 8, Article 6.3.4 General Conditions to Agreement of Construction, and must be made in writing to the AE, not later than 10 days prior to the bid opening. This "prior" approval of material or equipment as equal to that specified will be made in writing in the form of an addendum issued by the AE to all plan holders of record. The base bid and any alternate shall be based on materials only as specified or approved. It is the sole responsibility of the Contractor to document to the satisfaction of the AE that proposed material, item, or piece of equipment is equal or better than that identified on the plans or in the specifications. The requirements of this Article shall be strictly enforced. Failure of the Contractor to identify and submit in writing requests for approval not later than 10 days prior to the bid opening shall not be just cause for future request for or expectation of acceptance for substitution during the construction period.

1.6 SPECIAL CONTRACT REQUIREMENTS

- A. The Contractor covenants and agrees that it will comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330), as supplemented by Department of Labor regulations (29 CFR Part 5). As applied to this project, the Contract Work Hours and Safety Standards Act specifies that no laborer or mechanic doing any part of the work contemplated by this project shall be required or permitted to work more than 40 hours in any work week unless paid for all additional hours at not less than 1 1/2 times the basic rate of pay.
- B. The Contractor covenants and agrees that it will comply with Executive Order 11246 of September 24, 1965 entitled "Equal Employment Opportunity," as amended by Department of Labor regulations (41 CFR Chapter 60).
- C. The Contractor covenants and agrees that it will comply with the Copeland "Anti-Kickback" Act (18 U.S.C. 874), as supplemented in Department of Labor regulations (29 CFR Part 3). As applied to this project, the Copeland "Anti-Kickback" Act makes it unlawful to induce, by force, intimidation, threat of procuring dismissal from employment, or otherwise, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment.
- D. The Contractor covenants and agrees that it will comply with The Buy American Act (41 U.S.C. 10). The Buy American Act gives preference to domestic end products and domestic construction material. In addition, the Memorandum of Understanding between the United States of America and the European Economic Community (EEC) on Government Procurement, and the North American Free Trade Agreement (NAFTA), provide that EEC and NAFTA end products and construction materials are exempted from application of the Buy American Act.
- E. The Contractor covenants and agrees that it will comply with provisions of the Drug-Free Work Place Act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. § 701 et seq.) and will maintain a drug-free workplace. The Final Rule, Government-Wide Requirements for Drug-Free Workplace (Grants), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28, Subpart f) to implement provisions of the Drug-Free Work Place Act of 1988, is incorporated by reference and the Contractor covenants and agrees to comply with provisions thereof, including amendments to the Final Rule that may hereafter be issued.
- F. The Contractor covenants and agrees that no person shall be denied benefits, or otherwise be subjected to discrimination in connection with the Contractor's performance under this contract, on the grounds of race, religion, color, national origin, gender or handicap. Accordingly, and to the extent applicable, the Contractor covenants and agrees to comply with the following:
 - Title VII of the Civil Rights Act of 1964 (42 U.S.C. § 2000d <u>et seq</u>.), and DoD regulations issued thereunder (32 CFR Part 300);
 - 2. Executive Order 11246 and Department of Labor regulations issued thereunder (41 CFR Part 60);
 - 3. Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794) and DoD regulations issued thereunder (32 CFR Part 56); and
 - 4. The Age Discrimination Act of 1975 (42 U.S.C. § 6101 et seq.) and regulations issued thereunder (45 CFR Part 90).

1.7 PERMITS

- A. South Dakota Department of Agriculture and Natural Resources
 - Notice of Intent
 The SD Department of the Military will submit a Notice of Intent to Obtain Coverage Under the SWD
 General Permit for Stormwater Discharge Associated with Construction Activities.
 - 2. General Surface Water Discharge Permit
 - a. The Contractor shall obtain the General Surface Water Discharge Permit for Temporary Discharge Activities Under the South Dakota Surface Water Discharge System.
 - b. The Contractor shall conduct and maintain proper records for inspections, maintenance, and repairs as outlined in the permit requirements. A copy of all records shall be provided to the SD Dept. of the Military Project Manager.
- B. Local Municipalities
 - 1. The State of South Dakota and Contractors working under contracts with the State of South Dakota are not required to, nor shall they obtain a local municipality building, utility, or other permit(s) in accordance with Attorney General record of opinion of State Codified Law and Administrative Rules.

- 2. Local municipalities shall be granted access to the project site for inspection of construction activities. The local inspector shall provide a report of inspection and any recommendations to the SD Dept. of the Military Project Manager. The State will then review such recommendations and implement any recommendations at the State's discretion.
- PART 2 PRODUCTS

PART 3 – EXECUTION

END SECTION 01 01 00

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01 14 00 WORK RESTRICTIONS

PART 1 – GENERAL

- 1.1 GENERAL
 - A. This section outlines special site-specific requirements that the Contractor must comply with when working on South Dakota Department of the Military/SDARNG projects.

1.2 SPECIAL SITE CONDITIONS

- A. Tobacco Free Environment Policy:
 - In accordance with the Governor's Executive Order 2006-04; Effective July 1, 2006, smoking and the use of all tobacco products will be prohibited on all real property or portions thereof owned by the State of South Dakota under the direction and control of the Governor and all real property leased by the state. This policy applies to employees, clients, Contractors, visitors, and includes all vehicles, parking lots and walkways leading into facilities.
 - 2. Smoking is prohibited within and outside of all buildings, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines.
 - 3. The Project Manager will identify designated smoking areas.
 - 4. No Smoking Policy

The Contractor shall provide a written No Smoking Policy to the SD DOM Project Manager. This policy shall be provided to the Project Manager before, at, or no later than 10 calendar days from the date of the Notice to Proceed. The policy shall incorporate State of South Dakota requirements and the Contractor's plan for oversite and enforcement of the policy.

- B. Work Hours
 - 1. Regular working hours are established as:
 - a. Readiness Center or Training Facilities: 6:30AM to 5:00PM Monday through Friday.
 - b. Some facilities are not open on Monday's. Contractor may be limited to working a Tuesday through Friday (10-hour days) schedule or limited to working in common areas access areas.
 - c. Maintenance Shops: 6:30AM to 5:00PM Tuesday through Friday.
- C. Work Outside Regular Hours

Work outside regular working hours will be permitted in non-secure areas. Work within secure areas shall be coordinated with the Project Manager no less than 7 calendar days prior to such work to allow arrangements to be made. Make utility cutovers after normal working hours or on Saturdays, Sundays, Mondays, and holidays unless directed otherwise.

- C. Occupied and Existing Building[s]
 - 1. The Contractor shall be working in an existing building or around existing buildings which are occupied. Do not enter the building[s] without prior approval of the Project Manager.
 - 2. The existing buildings and their contents must be kept secure at all times.
 - 3. Provide temporary closures as required to maintain security as directed by the Contracting Officer.
 - 4. Provide dust covers or protective enclosures to protect existing work that remains, and Government material during the construction period.
 - 5. Relocate movable furniture away from the Contractor's working area as required to perform the work, protect the furniture, and replace the furniture in its original location[s] upon completion of the work. Leave attached equipment in place, and protect it against damage, or temporarily disconnect, relocate, protect, and reinstall it at the completion of the work.

1.3 WORK ON CAMP RAPID

- A. Only employees listed on an approved Employee Access List will be granted access onto Camp Rapid.
- B. Contractor shall comply with the requirement set forth in section 01 35 30 Security Requirements of this project manual.
- C. The Contractor shall contact the Dept. of the Military project manager on matters regarding traffic control, access to Camp Rapid, and other similar matters related to the site.

1.4 WORK ADJACENT TO AIRPORTS

A. The Contractor is advised that an area of the construction site is in close proximity to active runways, taxiways, and other aircraft operating areas. As a result, the Contractor will be required to comply with the applicable safety requirements set by the Airport and the Federal Aviation Administration (FAA).

- B. The Contractor is advised that the Airport and/or the FAA Air Traffic Control Tower (ATCT) may require the Contractor to schedule his work to minimize impacts to airport operations.
- C. An area of the construction site is located within the area of and is under the control of the Airport (generally noted as within the airport security fence). For work in this area, the Contractor is responsible to coordinate his work in advance with the Airport and with the ATCT, and for his full compliance with Airport and ATCT safety and security standards.
- D. The Airport is required to prevent unauthorized access and to ensure that proper badging and escort procedures are followed. The construction Contractor will need to coordinate all security and access issues with the Airport. The Contractor must ensure that his personnel remain within the limits of construction at all times that they are on the site. The Contractor must ensure that any access gates used to gain access to the construction site remained locked unless in use. When the access gate is in use, the Contractor will be required to provide one employee at the gate to control access and egress.
- E. The Contractor shall take all necessary measures to ensure that construction materials and debris are not blown by winds such that aviation/flight hazards result.
- F. The Airport and the ATCT requires 72 hour advance notification of the use of any cranes on the construction site, and to comply with all crane operation safety requirements established by the Regional Airport. Boom heights greater than 100' above the ground will not be allowed without special written permission by the Airport. When not in use, crane booms will be lowered.
- G. All construction shall be carried out in accordance with FAA Advisory Circular 150/5370-2C "Operational Safety on Airports during Construction". It is the Contractor's sole responsibility to ensure the requirements of this Advisory are fully complied with.
- H. The Contractor shall establish and maintain radio contact with the FAA Air Traffic Control Tower (ATCT), as required by the Airport, using radios provided by the Contractor.
- All construction equipment must be marked and lighted in accordance with FAA Advisory Circular 70/7460-1J, "Observation Marking and Lighting", Chapters 3, 4, 5, and 13. It is the Contractor's sole responsibility to ensure the requirements of this Advisory are fully complied with.
- J. The Contractor shall be responsible for locating utility lines and hand digging to locate FAA cabling and shall provide adequate provisions to protect all FAA cables exposed during the proposed work. The Contractor is responsible for advising the Airport and the ATCT, in writing, if cable relocation is required, and to fully coordinate any cable relocations with the Airport and ATCT to minimize any impact to airport operations. Any damage to Airport and/or FAA cables, access roads, or facilities shall be immediately repaired, to the satisfaction of the Airport and/or the FAA, at the Contractor's sole expense.
- K. The Contractor shall be responsible for erecting and maintaining lighting and barriers around the construction area, as may be required by the Airport and/or the ATCT.
- L. The Contractor shall strictly avoid driving on runways, taxiways, ramps, and aprons. If for any reason, the Contractor leaves dirt and debris on these surfaces, they shall be immediately cleaned, to the satisfaction of the Regional Airport and/or the ATCT.

1.4 UTILITY CUTOVERS AND INTERRUPTIONS

- A. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, Mondays, and Government holidays. Conform to procedures required in paragraph WORK OUTSIDE REGULAR HOURS.
- B. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- C. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, and compressed air are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.

PART 2 – PRODUCTS

PART 3 – EXECUTION

END SECTION 01 14 00

01 18 00 PROJECT UTILITIES

PART 1 – GENERAL

1.1 SUMMARY

This section covers Utility Locate Services and the availability of utilities to the Contractor in order to complete the scope of work included with the project.

1.2 UTILITY LOCATES

- A. The Contractor shall contact SD One Call and ensure utilities are marked prior to any excavation taking place. The Contractor shall provide a copy of each SD One Call utility request submitted for record keeping purposes.
- B. Contractor shall coordinate and pay for a private locate service to mark all utility locations on State of South Dakota property or leased property on which public utilities will not conduct locates. The Contractor shall submit the private utility locator's employee information to include company name, employee name, and date of birth, and driver's license number for a background check and clearance prior to being able to conduct work at a SDARNG facility.

1.3 WATER

- A. The Owner will furnish all water required for use on the project.
- B. The Contractor shall provide all means of conveying water to place where required, including temporary valves, meters, pipe, etc., and remove any such temporary means when their purpose has been served.
- C. If necessary the Mechanical Contractor shall provide a temporary water connection for the use of all Contractors at the job site and on each floor as the project progresses. They will expedite the permanent water service and furnish outlets for use of all Contractors.

1.4 ELECTRICITY

A. The Contractor may utilize existing electrical infrastructure within the facility. Any specialty electrical needs for equipment shall be arranged, installed, maintained, and removed by a licensed electrical contractor.

1.5 HEAT

- A. The Contractor will furnish, install, maintain, and be responsible for the costs associated with all temporary equipment and materials necessary to provide temporary heating services to the location of construction.
- B. The Contractor may utilize existing building HVAC heating systems and sources without making any modifications to the existing HVAC heating systems. Heating energy, and costs associated with HVAC heating system operation, will be provided by the Owner.
- C. The Contractor may not use Owner furnished electricity identified in paragraph 1.4 above for heating purposes of spaces larger than 400 SF.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END SECTION 01 18 00

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01 30 00 ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 OVERVIEW

This section outlines the administrative requirements for the project in its entirety.

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Progress and Completion Pictures
- B. Performance Assessment Plan (PAP)

1.3 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Include aerial photographs. Provide once every two weeks, and within one week of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 20 digital photographs every two weeks throughout the entire project from a minimum of ten different viewpoints selected by the Contractor unless otherwise directed by the Project Manager.

Photos shall be included in the bi-weekly progress reports. The digital files shall be submitted on an electronic submittal exchange program, if utilized, or at the end of the project on a separate compact disc (CD) or data versatile disc (DVD), cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Provide photographs in a separate directory indicating the end date for the two-week period represented and name each file to indicate its location on the view location sketch. Also provide the view location sketch on the CD or DVD as a digital file. Include a date designator in file names. Photographs provided are for unrestricted use by the Owner.

1.4 SUPERVISION

A. Superintendent Qualifications

Provide project superintendent with a minimum of 10 years' experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Project Manager may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question. For projects where the superintendent is permitted to also serve as the Quality Control (QC) Manager as established in Section 01 45 00 QUALITY CONTROL, the superintendent must have qualifications in accordance with that section.

B. Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

C. Duties

The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend Red Zone meetings, partnering meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

D. Non-Compliance Actions

The Project Superintendent is subject to removal by the Project Manager for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Project Manager may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

1.5 PRECONSTRUCTION MEETING CONFERENCE

After award, prior to commencing any work at the site, coordinate with the Project Manager a time and place to meet for the Preconstruction Meeting Conference. The meeting conference must take place within 21 calendar days after award of the contract, but prior to commencement of any work at the site. The purpose of this meeting conference is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, sediment and erosion control inspections and maintenance, invoicing, value engineering, safety, sitee-access, outage requests, hot work permits, schedule requirements, quality control, schedule of prices or earned value report, shop drawings, submittals, prosecution of the work, acceptance of work, final inspections and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and any required phasing.

A. Attendees: Contractor attendees must include the Project Manager, Superintendent, Site Safety and Health Officer (SSHO), Quality Control Manager and major subcontractors.

1.6 PROGRESS MEETINGS

The Contractor shall coordinate and conduct progress meetings every other week at a day and time agreed upon at the Preconstruction meeting. The Contractor shall provide meeting minutes from the previous meeting for review. The Contractor shall provide a bi-weekly report summarizing work completed over the past two weeks and include Progress Pictures as outlined above. The Contractor shall provide the Progress Meeting agenda which shall include, at a minimum, schedule of submittals, RFI/ASI/RFP schedules, project schedule, erosion control review, critical issues, safety concerns, AE concerns, Owner Concerns, Subcontractor concerns, and look ahead.

1.7 FACILITY TURNOVER PLANNING MEETINGS (RED ZONE MEETINGS)

Meet to identify strategies to ensure the project is carried to expeditious closure and turnover to the Owner. Start planning the turnover process at the Pre-Construction Conference meeting with a discussion of the Red Zone process and convene at regularly scheduled Red Zone Meetings beginning at approximately 75 percent of project completion. Include the following in the facility Turnover effort:

- A. Red Zone Checklist
 - a. Project Manager's will provide the Contractor a copy of the Red Zone Checklist template.
 - b. Prior to 75 percent completion, modify the Red Zone Checklist template by adding or deleting critical activities applicable to the project and assign planned completion dates for each activity. Submit the modified Red Zone Checklist to the Project Manager. The Project Manager may request additional activities be added to the Red Zone Checklist at any time as necessary.

B. Meetings

- a. Conduct regular Red Zone Meetings beginning at approximately 75 percent project completion, or three to six months prior to Beneficial Occupancy Date (BOD), whichever comes first.
- b. The Project Manager will establish the frequency of the meetings, which is expected to increase as the project completion draws nearer. At the beginning, Red Zone meetings may be every two weeks then increase to weekly towards the final month of the project.
- c. Using the Red Zone Checklist as a Plan of Action and Milestones (POAM) and basis for discussion, review upcoming critical activities and strategies to ensure work is completed on time.
- d. During the Red Zone Meetings discuss with the Project Manager any upcoming activities that require Owner involvement.
- e. Maintain the Red Zone Checklist by documenting the actual completion dates as work is completed and update the Red Zone Checklist with revised planned completion dates as necessary to match progress. Distribute copies of the current Red Zone Checklist to attendees at each Red Zone Meeting.

1.8 MOBILIZATION

Contractor shall mobilize to the jobsite within 10 calendar days after Notice to Proceed. Mobilize is defined as having equipment AND having a physical presence of at least one person from the contractor's team on the jobsite.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 30 00

01 32 16 PROJECT SCHEDULES

PART 1 – GENERAL

1.1 SUMMARY

- A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.
- B. Construction Progress Schedule shall comply with the requirements set forth in General Conditions Article 6 of the Agreement for Construction.

1.2 CONTRACTOR'S REPRESENTATIVE

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Dept. of the Military (DOM) Project Manager.
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.

1.3 PROJECT SCHEDULE SUBMITTAL

- A. Contractor shall prepare and submit Construction Progress Schedules in accordance with the General Conditions Article 6 to the Agreement for Construction.
- B. Original Submittal:
 - 1. Within 10 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Project Manager's review.
 - 2. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, early start date, early finish date, late start date, late finish date and total float.
 - 3. Work activity/event relationships shall be restricted to finish-to-start and start-to-start without lead or lag constraints.
 - 4. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Project Manager.
 - 5. The complete working Project Schedule shall reflect the Contractor's approach to scheduling the complete project and shall meet the detailed requirements.
- C. Progress Schedules
 - 1. Shall be prepared in accordance with the requirements set forth in this section for the original project schedule and shall be distributed for review at each project progress meeting.

1.4 PROJECT SCHEDULE DETAILED REQUIREMENTS

A. Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Project Manager will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

B. Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities may have Original Durations (OD) greater than 30 calendar days.

C. Design and Permit Activities

Include design and permit activities with the necessary conferences and follow-up actions and design package submission dates. Include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. Provide at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Also include review and correction periods associated with each item.

D. Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

E. Mandatory Tasks

Include the following activities/tasks in the initial project schedule and all updates.

- a. Submission, review and acceptance of Preconstruction Submittals (individual activity for each).
- b. Submission, review and acceptance of features require design completion Submission, review and acceptance of design packages.
- c. Submission of mechanical/electrical/information systems layout drawings.
- d. Long procurement activities
- e. Submission and approval of O&M manuals with Training Videos.
- f. Submission and approval of as-built drawings.
- g. Submission and approval of DD1354 data and installed equipment lists.
- h. Submission and approval of BUILDER Data
- i. Submission and approval of Build America, Buy America Certification
- j. Submission and approval of EPA and USDA Recycled Content Certifications
- k. Submission and approval of testing and air balance (TAB).
- I. Submission of TAB specialist design review report.
- m. Submission and approval of Fire Protection specialties.
- n. Submission and approval of Building Commissioning Plan, test data, and reports: Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the contract commissioning requirements. All tasks associated with all building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.
- o. Air and water balancing.
- p. Building commissioning Functional Performance Testing.
- q. Controls testing plan submission.
- r. Controls testing.
- s. Performance Verification testing.
- t. Other systems testing, if required.
- u. Contractor's pre-final inspection.
- v. Correction of punch list from Contractor's pre-final inspection.
- w. Owner's pre-final inspection.
- x. Correction of punch list from Owner's pre-final inspection.
- y. Final inspection.

1.5 PROGRESS REPORTING

- A. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the AE and Project Manager three work days in advance of the scheduled progress meeting.
- B. Job progress will be reviewed to verify:
 - 1. Actual start and/or finish dates for updated/completed activities/events.
 - 2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
 - 3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
 - 4. Changes in activity/event sequence and/or duration which have been made.
 - 5. Completion percentage for all completed and partially completed activities/events.
 - 6. Logic and duration revisions required by this section of the specifications.
 - 7. Activity/event duration and percent complete shall be updated independently.
- C. The Contractor, AE, and Project Manager shall review the schedule at the progress meeting and mutually agree on current progress, delays, and adjustments.
- D. After completion of the joint review, the contractor shall generate an updated computer-produced calendardated schedule and submit to the AE and Project Manager.

1.6 PAYMENT TO THE CONTRACTOR

- A. The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.
- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

1.7 RESPONSIBILITY FOR COMPLETION

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
 - 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
 - 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 - 3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the AE and Project Manager for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost.

1.8 ADJUSTMENT OF CONTRACT COMPLETION

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the AE and Project Manager may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract.
- B. Submission of proof based on revised activity/event logic, durations (in work days) is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Project Manager's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- C. The Contractor shall submit each request for a change in the contract completion date to the Project Manager in writing accordance with the contract documents and procedures.
- D. All delays due to non-work activities/events such as RFI's, Weather, and similar non-work activities/events shall be analyzed on a month by month basis.

1.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Project Manager may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra workdays, etc.

A. Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

B. Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Project Manager pursuant to the provisions of the General Conditions of the contract.

C. Recovery Schedule Should the Project Manager find it necessary, submit a recovery schedule.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION 01 32 16

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01 33 00 SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Submittal Information

The Project Manager may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

B. Project Type

The Contractor's Quality Control (CQC) System Manager are to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

The Contractor and the Designer of Record (DOR), if applicable, are to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

C. Submission of Submittals

Schedule and provide submittals requiring Owner approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

A. Submittal Descriptions

Submittal requirements are specified in the technical sections.

1. Preconstruction Submittals

Submittals that are required prior to or commencing with the start of work on site. Submittals that are required prior to or at the start of construction (work) or the next major phase of the construction on a multiphase contract. Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

- a. Certificates Of Insurance
- b. Surety Bond
- c. List Of Proposed Subcontractors
- d. List Of Proposed Products
- e. Submittal Register
- f. Schedule Of Values
- g. Accident Prevention Plan
- h. Work Plan
- i. Quality Control (QC) plan
- j. Environmental Protection Plan
- 2. Shop Drawings
 - a. Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.
 - b. Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.
 - c. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.
- 3. Product Data
 - a. Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

- b. Samples of warranty language when the contract requires extended product warranties.
- 4. Samples
 - a. Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.
 - b. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.
 - c. Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.
- 5. Design Data
 - a. Design calculations, mix designs, analyses or other data pertaining to a part of work.
 - b. Design submittals, design substantiation submittals and extensions of design submittals.
- 6. Test Reports
 - a. Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.
 - b. Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.
 - c. Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
 - d. Investigation reports
 - e. Daily logs and checklists
 - f. Final acceptance test and operational test procedure
- 7. Certificates
 - a. Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.
 - b. Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.
 - c. Confined space entry permits
 - d. Text of posted operating instructions
- 8. Manufacturer's Instructions
 - a. Preprinted material describing installation of a product, system or material, including special notices and (SDS)concerning impedances, hazards and safety precautions.
- 9. Manufacturer's Field Reports
 - a. Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.
 - b. Factory test reports.
- 10. Operation and Maintenance Data
 - a. Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.
 - b. Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.
 - c. Data incorporated in an operations and maintenance manual or control system.
- 11. Closeout Submittals
 - a. Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.
 - b. Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

- c. Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.
- B. Approving Authority
 - Office or designated person authorized to approve the submittal.
- C. Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce submittals.

1.3 PREPARATION

A. Transmittal Form

Transmit each submittal, except sample installations and sample panels to the office of the approving authority using the transmittal form prescribed by the Project Manager. Include all information prescribed by the transmittal form and required in paragraph IDENTIFYING SUBMITTALS. Use the submittal transmittal forms to record actions regarding samples.

Use the ENG Form 4025-R transmittal form for submitting both Owner-approved and information-only submittals. Submit in accordance with the instructions on the reverse side of the form. These forms or similar forms are included in the eCMS software that the Contractor is required to use for this contract. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

B. Identifying Submittals

The Contractor's Quality Control Manager must prepare, review and stamp submittals, including those provided by a subcontractor, before submittal to the Owner. Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- 1. Project title and location
- 2. Construction contract number
- 3. Dates of the drawings and revisions
- 4. Name, address, and telephone number of Subcontractor, supplier, manufacturer, and any other Subcontractor associated with the submittal.
- 5. Section number of the specification by which submittal is required
- 6. Submittal description (SD) number of each component of submittal
- 7. For a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission
- 8. Product identification and location in project.
- C. Submittal Format
 - 1. Format of Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document. Provide data in the unit of measure used in the contract documents.

2. Format for Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

- a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.
- b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Present shop drawings sized 8 1/2 by 11 inches as part of the bound volume for submittals. Present larger drawings in sets. Submit an electronic copy of drawings in PDF format.

c. Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Owner contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, on the right-hand side of each sheet for the Owner disposition stamp.

3. Format of Product Data

Present product data submittals for each section as a complete, bound volume. Include a table of contents, listing the page and catalog item numbers for product data. Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

a. Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of Certificates. Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

b. Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Project Manager. State on the certificate that the item has been tested in accordance with the specified organization's reference standard.

c. Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort. Submit the manufacturer's instructions before installation.

4. Format of Samples

1. Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
- c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
- d. Sample of Linear Devices or Materials: 10-inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
- e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.
- g. Sample Panel: 4 by 4 feet.
- h. Sample Installation: 100 square feet.
- b. Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use. Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation but remove the notation at the final clean-up of the project. c. Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

- Format of Design Data Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.
- Format of Test Reports
 Provide reports on 8 1/2 by 11 inch paper in a complete bound volume. By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.
- Format of Certificates
 Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.
- 8. Format of Manufacturer's Instructions

Present manufacturer's instructions submittals for each section as a complete, bound volume. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for Certificates. Submit the manufacturer's instructions before installation.

a. Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Project Manager. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

9. Format of Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume. By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

- Format of SD-10 Operation and Maintenance Data (O&M) Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.
- 11. Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document. Provide data in the unit of measure used in the contract documents.

- D. Source Drawings for Shop Drawings
 - 1. Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

- 2. Terms and Conditions
 - a. Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Owner. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Owner, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Owner harmless against all damages, liabilities, or costs, including

reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

- b. These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Owner makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Owner and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).
- E. Electronic File Format
 - 1. Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Project Manager. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Project Manager. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.
 - 2. E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Project Manager. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the AMRDEC SAFE Web Application located at the following website: https://safe.amrdec.army.mil/safe/.

1.4 QUANTITY OF SUBMITTALS

- Number of Preconstruction Submittal Copies
 Unless otherwise specified, submit three sets of administrative submittals.
- B. Number of SD-02 Shop Drawing Copies
 Submit three copies of submittals of shop drawings requiring review and approval by a QC organization.
 Submit three copies of shop drawings requiring review and approval by the Project Manager.
- C. Number of SD-03 Product Data Copies Submit in compliance with quantity requirements specified for shop drawings.
- D. Number of Samples
 - 1. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.
 - 2. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.
 - 3. Submit one sample installation, where directed.
 - 4. Submit one sample of nonsolid materials.
- E. Number of Design Data Copies Submit in compliance with quantity requirements specified for shop drawings.
- F. Number of Test Report Copies Submit in compliance with quantity and quality requirements specified for shop drawings, other than field test results that will be submitted with QC reports.
- G. Number of Certificate Copies Submit in compliance with quantity requirements specified for shop drawings.
- H. Number of Manufacturer's Instructions Copies
 Submit in compliance with quantity requirements specified for shop drawings.

- Number of Manufacturer's Field Report Copies Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.
- J. Number of Operation and Maintenance Data Copies Submit three copies of O&M data to the Project Manager for review and approval.
- K. Number of Closeout Submittals Copies Unless otherwise specified, submit three sets of administrative submittals.

1.5 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Project Manager for information-only. Provide information-only submittals to the Project Manager a minimum of 14 calendar days prior to the Preparatory Meeting for the associated Definable Feature of Work (DFOW). Approval of the Project Manager is not required on information only submittals. The Project Manager will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Owner reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Project Manager from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Owner laboratory or for check testing by the Owner in those instances where the technical specifications so prescribe.

1.6 PROJECT SUBMITTAL REGISTER AND DATABASE

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register."

A. Submittal Management

Prepare and maintain a submittal register, as the work progresses. Use an electronic submittal register program furnished by the Owner. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Owner; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required. Maintain a submittal register for the project in electronic format with the following fields completed, to the extent that will be required by the Owner during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Column (f): Lists the approving authority for each submittal.

The database and submittal management program will be furnished to the Contractor on a writable compact disk (CD-R), for operation on a Windows-based personal computer.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Owner.

B. Design-Build Submittal Register

The Designer of Record develops a complete list of submittals during design and identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all inclusive and additional submittals may be required by other parts of the contract. Complete the submittal register and submit it to the Project Manager for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. Coordinate the submit dates and need dates with dates in the Contractor prepared progress schedule. Submit monthly or until all submittals have been satisfactorily completed, updates to the submittal register showing the Contractor action codes and actual dates with Owner action codes. Revise the submittal register when the progress schedule is revised and submit both for approval.

C. Preconstruction Use of Submittal Register

Submit the submittal register as an electronic database, using the submittal management program furnished to Contractor. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register database submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals. Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

- Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.
- D. Contractor Use of Submittal Register

Update the following fields in the Owner-furnished submittal register program or equivalent fields in the program used by the Contractor with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (I) Date submittal transmitted.

Column (q) Date approval was received.

E. Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (I) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

F. Action Codes

Entries for columns (j) and (o) are to be used as follows (others may be prescribed by the Transmittal Form):

- 1. Owner Review Action Codes
 - "A" "Approved as submitted"; "Completed"
 - "B" "Approved, except as noted on drawings"; "Completed"
 - "C" "Approved, except as noted on drawings; resubmission required"; "Resubmit"
 - "D" "Returned by separate correspondence"; "Completed"
 - "E" "Disapproved (See attached)"; "Resubmit"
 - "F" "Receipt acknowledged"; "Completed"
 - "G" "Other (Specify)"; "Resubmit"
 - "X" "Receipt acknowledged, does not comply with contract requirements"; "Resubmit"
- 2. Owner Review Action Codes
 - "A" "Approved as submitted"
 - "AN" "Approved as noted"
 - "RR" "Disapproved as submitted"; "Completed"
 - "NR" "Not Reviewed"
 - "RA" "Receipt Acknowledged"
- 3. Contractor Action Codes
- G. Delivery of Copies

Submit an updated electronic copy of the submittal register to the Project Manager with each invoice request, unless a paper copy is requested by the Project Manager. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

1.7 VARIATIONS

Variations from contract requirements require Project Manager approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction and will be considered where advantageous to the Owner.

A. Considering Variations

Discussion of variations with the Project Manager before submission of a variation submittal will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the Owner may require an evaluation and analysis by a licensed professional engineer hired by the contractor.

Specifically point out variations from contract requirements in a transmittal letter and variation submittal. Failure to point out variations may cause the Owner to require rejection and removal of such work at no additional cost to the Owner.

- B. Proposing Variations
 - 1. When proposing variation, deliver a submittal, clearly marked as a "VARIATION" to the Project Manager, with documentation illustrating the nature and features of the variation including any necessary technical submittals and why the variation is desirable and beneficial to Owner. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.
 - 2. The Project Manager will indicate an approval or disapproval of the variation request; and if not approved as submitted, will indicate the Owner's reasons, therefore. Any work done before such approval is received is performed at the Contractor's risk."
 - 3. Specifically point out variations from contract requirements in a transmittal letter and variation submittal. Failure to point out variations may cause the Owner to require rejection and removal of such work at no additional cost to the Owner.
 - 4. Check the column "variation" of ENG Form 4025 for submittals that include variations proposed by the Contractor. Set forth in writing the reason for any variations and note such variations on the submittal. The Owner reserves the right to rescind inadvertent approval of submittals containing unnoted variations.
- C. Warranting that Variations are Compatible When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.
- D. Review Schedule Extension

In addition to the normal submittal review period, a period of 14 calendar working days will be allowed for the Owner to consider submittals with variations.

1.8 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. Allow an additional 7 calendar working days for review and approval of submittals for food service equipment and refrigeration and HVAC control systems.

- A. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Owner reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.
- B. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Project Manager does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."
- C. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.
- D. Project Manager review will be completed within 7 calendar working days after the date of submission.
- E. Except as specified otherwise, allow a review period, beginning with receipt by the approving authority, that includes at least 15 working days for submittals for QC manager approval and 20 working days for submittals where the Project Manager is the approving authority. The period of review for submittals with Project Manager approval begins when the Owner receives the submittal from the QC organization.
- F. For submittals requiring review by a Owner fire protection engineer, allow a review period, beginning when the Owner receives the submittal from the QC organization, of 30 working days for return of the submittal to the Contractor.
- G. At the Preconstruction conference, provide the following schedule of submittals for approval by the Project Manager:
- H. A schedule of shop drawings and technical submittals required by the specifications and drawings. Indicate the specification or drawing reference requiring the submittal; the material, item, or process for which the submittal is required; the division number and identifying title of the submittal; the anticipated submission date, and the approval need date.
- I. A separate schedule of other submittals required under the contract but not listed in the specifications or drawings. Indicate the contract requirement reference, the type or title of the submittal, the anticipated submission date, and the approval need date (if approval is required).

- J. Reviewing, Certifying, and Approving Authority
- K. The QC Manager is responsible for reviewing all submittals and certifying that they are in compliance with contract requirements. The approving authority on submittals is the QC Manager unless otherwise specified. At each "Submittal" paragraph in individual specification sections, a notation "G" following a submittal item indicates that the Project Manager is the approving authority for that submittal item. Provide an additional copy of the submittal to the Owner Approving authority
- L. Constraints
- M. Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract. Submit complete submittals for each definable feature of the work. At the same time, submit components of definable features that are interrelated as a system. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, the submittal will be returned without review. Approval of a separate material, product, or component does not imply approval of the assembly in which the item functions.
- N. QC Organization Responsibilities
 - 1. Review submittals for conformance with project design concepts and compliance with contract documents.
 - 2. Process submittals based on the approving authority indicated in the submittal register.
 - a. When the QC manager is the approving authority, take appropriate action on the submittal from the possible actions defined in paragraph APPROVED SUBMITTALS.
 - b. When the Project Manager is the approving authority or when variation has been proposed, forward the submittal to the Owner, along with a certifying statement, or return the submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of the submittal determines the appropriate action.
 - c. Ensure that material is clearly legible.
 - d. Stamp each sheet of each submittal with a QC certifying statement or an approving statement, except that data submitted in a bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.
 - 1) When the approving authority is the Project Manager, the QC organization will certify submittals forwarded to the Project Manager with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated within the project is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Owner approval.

Certified by Submittal Reviewer _____, Date _____, Date _____, Signature when applicable)

Certified by QC Manager _____, Date _____' (Signature)

2) When approving authority is the QC manager, the QC manager will use the following approval statement when returning submittals to the Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated within the project is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer _____, Date _____, Date _____, Signature when applicable)

Approved by QC Manager ______, Date _____" (Signature)

e. Sign the certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.

- f. Update the submittal register as submittal actions occur, and maintain the submittal register at the project site until final acceptance of all work by the Project Manager.
- g. Retain a copy of approved submittals and approved samples at the project site.
- h. For "S" submittals, provide a copy of the approved submittal to the Owner Approving authority.

1.9 OWNER APPROVING AUTHORITY

When the approving authority is the Project Manager, the Owner will:

- A. Note the date on which the submittal was received from the QC manager.
- B. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- C. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.
- D. Upon completion of review of submittals requiring Owner approval, stamp and date submittals. One copy of the submittal will be retained by the Project Manager and one copy of the submittal will be returned to the Contractor.
- E. Review Notations
 - Submittals will be returned to the Contractor with the following notations:
 - 1. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.
 - 2. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.
 - 3. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.
 - 4. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.
 - 5. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Owner. This applies only to "information-only submittals" as previously defined.

1.10 DISAPPROVED SUBMITTALS

- A. Make corrections required by the Project Manager. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Project Manager as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Owner to require rejection and removal of such work at the Contractor's expense.
- B. If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.11 APPROVED SUBMITTALS

- A. The Project Manager's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory. the design, general method of construction, materials, detailing, and other information appear to meet the Solicitation and Accepted Proposal.
- B. Approval or acceptance by the Owner for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained within each submittal accurately conforms with the requirements of the contract documents.
- C. After submittals have been approved or accepted by the Project Manager, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.12 APPROVED SAMPLES

- A. Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.
- B. Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.
- C. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Owner reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.
- D. Samples of various materials or equipment delivered on the site or in place may be taken by the Project Manager for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

1.13 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made unless all required DOR approvals or required Owner approvals have been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information-only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.14 CERTIFICATION OF SUBMITTAL DATA

Certify the submittal data as follows on Form ENG 4025: "I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

_____NAME OF CONTRACTOR ______ SIGNATURE OF CONTRACTOR

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

-- End of Section 01 33 00 --

01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted to the SD Dept. of the Military and/or AE for review to establish compliance with the contract documents.
- B. Detailed submittal requirements are found in the technical sections of the specifications. The SD Dept. of the Military and/or AE may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost.
- C. Approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

- A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.
- B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.
- C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.
- D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.
- E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.
- F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
- G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.
- H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.
- I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.
- J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.
- K. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 SUBMITTAL REGISTER

A. The submittal register will list items of equipment and materials for which submittals are required by the specifications. This list may not be all inclusive and additional submittals may be required by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents but which have been omitted from the submittal register.

- B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.
- C. The Contractor will provide the initial submittal register in electronic format. Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are submitted, returned for correction, and approved, and any comments or additional instruction provided.
- D. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work.
- E. The Contractor shall provide/submit formal updates of the submittal register at each progress meeting.

1.4 SUBMITTAL SCHEDULING

- A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.
- B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.
- C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.
- D. All submittals are required to be approved prior to the start of the specified work activity.

1.5 SUBMITTAL PREPARATION

- A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.
- B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.
- C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.
- D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned with review.
- E. Provide a transmittal form for each submittal with the following information:
 - 1. Project title, location and number.
 - 2. Construction contract number.
 - 3. Date of the drawings and revisions.
 - 4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
 - 5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
 - 6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
 - 7. Product identification and location in project.
- F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in required removal and replacement of such work at the Contractor's expense.
- G. Stamp, sign, and date each submittal transmittal form indicating action taken.

1.6 ADDITIONAL REQUIRED DATA

- A. All submittals shall clearly indicate compliance with the Infrastructure Investment and Jobs Act Pub, Title IX – Build America, Buy America (BABA). All of the iron, steel, manufactured products, and construction materials used in the project must be produced in the United States in accordance with the BABA requirements.
- B. All submittals shall clearly indicate recycled content of all materials and compliance with the EPA procurement guideline.
 - 1. All products to be used and/or installed shall be composed of the highest percent of recovered material or biobased content practicable, or at least meet, but may exceed, the minimum recovered materials or biobased content of an EPA or USDA designated product.

- Product Supplier Directory for EPA purchasing recommendations related to Recovered Materials Advisory Notice is available at <u>https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program</u>
- 3. USDA designated items are available at http://www.biopreferred.gov

C. Exemptions

- 1. Only products identified in the construction documents to be of virgin material.
- 2. Should the Contractor encounter difficulties finding products produced in the United State or wishing to use a product not containing recovered material meeting the EPA recovered content guidelines, a waiver may be requested.
 - a. Waivers will require review and approval from National Guard Bureau and will take an extensive period of time for review and approval.
 - b. Contractor is made aware of the requirement as additional time will not be granted for waiver of noncompliant products.
 - c. Written justification and documented approval must be included in the shop drawing submittal for any noncompliant products/materials.

1.7 SUBMITTAL FORMAT AND TRANSMISSION

- A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed.
- B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.
- C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.
- D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the SD Dept. of the Military and/or AE.
- E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed by all parties. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.
- F. Provide hard copies of submittals when requested. Up to 3 hard copies of any submittal may be requested at no additional cost.

1.8 SAMPLES

- A. Submit two sets of physical samples showing range of variation, for each required item.
- B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.
- C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.
- D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities and timeframe required in the project. No change, substitution, or time extension will be permitted after a sample has been approved.
- E. The SD Dept. of the Military reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.
- F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit data specified for a given item within O&M Manual.

1.10 TEST REPORTS

- A. If materials or quality control testing is required, the SD Dept. of the Military will hire an independent Testing Firm.
- B. Specific tests may be required after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

1.11 REVIEW OF SUBMITTALS AND RFI

- A. SD Dept. of the Military and/or AE will review all submittals for compliance with the technical requirements of the contract documents. The AE for this project will assist the SD Dept. of the Military in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.
- B. Period of review for submittals begins when the submittal is received from the Contractor.
- C. Period of review for each resubmittal is the same as for initial submittal.
- D. Review period is 15 working days for submittals.
- E. Review period is 10 working days for RFIs.
- F. Submittals will be returned to the Contractor with the following notations:
 - 1. "Approved": authorizes the Contractor to proceed with the work covered.
 - 2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
 - 3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
 - 4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.12 APPROVED SUBMITTALS

- A. Approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.
- B. Approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.
- C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.
- D. Retain a copy of all approved submittals at project site, including approved samples.

1.13 WITHHOLDING OF PAYMENT

A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END SECTION 01 33 23
01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING

PART 1 GENERAL

1.1 SUMMARY

This section includes requirements for Sustainability documentation and reporting submittals per the federally mandated High Performance and Sustainable Building (HPSB) or HPSB "Guiding Principles" (GP), in accordance with UFC 1-200-02 High Performance and Sustainable Building Requirements, and other identified requirements.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

	COUNCIL ON ENVIRONMENTA	L QUALITY (CEQ) (WHITE HOUSE)	
	HPSB Guiding Principles	Guiding Principles for Sustainable Federal Buildings and Determining	
		Compliance with the Guiding Principles for Sustainable Federal Buildings	
	GREEN BUILDING INITIATIVE (GBI)		
	GBI DOD GP Compliance	GBI Department of Defense Guiding Principles Compliance Program for New Construction	
	GBI Green Globes for NC	Green Globes(tm) for New Construction Technical Reference Manual	
	GREEN BUSINESS CERTIFICATI	ON INC. (GBCI)	
	GP Assessment (DOD)	Guiding Principles Assessment for Department of Defense	
	INTERNATIONAL CODE COUNCIL (ICC)		
	ICC IgCC	International Green Construction Code	
	SHEET METAL AND AIR CONDI	TIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)	
	ANSI/SMACNA 008	IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition	
	U.S. DEPARTMENT OF AGRICU	ILTURE (USDA)	
	FSRIA 9002	Farm Security and Rural Investment Act Section 9002 (USDA BioPreferred Program)	
	U.S. DEPARTMENT OF DEFENSE	E (DOD)	
	UFC 1-200-02	High Performance and Sustainable Building Requirements	
	UFC 3-210-10	Low Impact Development	
	UFC 3-600-01	Fire Protection Engineering for Facilities	
U.S. DEPARTMENT OF ENERGY (DOE)		((DOE)	
	Energy Star	Energy Star Energy Efficiency Labeling System (FEMP)	
	U.S. GREEN BUILDING COUNC	IL (USGBC)	
	LEED v4 BD+C	LEED v4 Building Design and Construction	
	U.S. NATIONAL ARCHIVES AND	RECORDS ADMINISTRATION (NARA)	
	10 CFR 433.300	Subpart C - Green Building Certification for Federal Buildings	
	40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials	
SUI	BMITTALS		
Sub	mit the following in accordance	e with Section 01 33 00 SUBMITTAL PROCEDURES:	
Α.	Preconstruction Submittals		

- 1. Preliminary High Performance and Sustainable Building Checklist
- 2. Sustainability Action Plan
- B. Design Data

1.3

- 1. Interim Design High Performance and Sustainable Building Checklist
- 2. Interim Design Sustainability eNotebook
- 3. Final Design High Performance and Sustainable Building Checklist
- 4. Final Design Sustainability eNotebook
- C. Test Reports
 - 1. Third Party Certification Design Compliance Report
- D. Closeout Submittals
 - 1. Final High Performance and Sustainable Building Checklist
 - 2. Final Sustainability eNotebook
 - 3. Amended Final Sustainability eNotebook
 - 4. Amended Final High Performance and Sustainable Building Checklist
 - 5. Third Party Certification Certificate, Assessment, or Validation and Compliance Report

1.4 GUIDING PRINCIPLES VALIDATION (GPV)

Provide the following sustainability activities and documentation to verify achievement of HPSB Guiding Principles Validation (GPV):

- A. Analysis of each Guiding Principle Requirement and how project complies. Include final Owner approved narrative(s) in the HPSB Checklist submittal. Multiple checklists indicate multiple buildings that require individual HPSB Checklist tracking.
- B. No changes to the HPSB Checklist are allowed without approval from the Project Manager, in accordance with Section 01 33 00 SUBMITTAL REQUIREMENTS. Immediately bring to the attention of the Project Manager any project changes that impact meeting the approved HPSB Guiding Principles Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.
- C. Documentation of all work required to incorporate the applicable HPSB Guiding Principles requirements indicated on the HPSB Checklist and in this contract.
- D. Sustainability Action Plan.
- E. Design and construction related documentation for the project Sustainability eNotebook and keep updated with regularly-scheduled Construction Quality Control Meetings. Include design and construction related documentation containing the following components:
- F. Construction related documentation for the project Sustainability eNotebook and keep updated with regularly-scheduled Construction Quality Control Meetings. Include construction related documentation containing the following components:
 - 1. HPSB Checklist(s)
 - 2. Sustainability Action Plan
 - 3. Documentation illustrating HPSB Guiding Principles Requirements compliance
- G. Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

- 1. Analysis of each HPSB Guiding Principles Requirement and how project will comply. Final Owner approved narrative(s) must be included in the HPSB Checklist submittal.
- Name and contact information for: Contractor's Point of Contact (POC) ensuring sustainability goals are accomplished and documentation is assembled. For Third Party Certification (TPC) that include on-site visit by third party representative, provide list of required attendees.
- 3. Indoor Air Quality plan.
- H. Calculations

Provide all design data, calculations, product data, labels and product certifications required in this specification to demonstrate compliance with the HPSB Guiding Principles Requirements. Provide all calculations, product data, labels and product certifications required in this specification to demonstrate compliance with the HPSB Guiding Principles Requirements.

1.5 SUSTAINABILITY SUBMITTALS

Provide HPSB Checklist and other documentation in the Sustainability eNotebook to indicate compliance with the sustainability requirements of the project.

 A. High Performance Sustainable Building (HPSB) Checklist Provide construction documentation that provides proof of, and supports compliance with, the completed HPSB Checklist. 1. HPSB Checklist Submittals

Submit updated HPSB Checklist with each Sustainability eNotebook submittal. Include the final HPSB Checklist(s) with the interim DD1354 Real Property Record Submittal.

B. "S" Submittals for Sustainability Documentation

"S" submittals are the sustainability documentation requirements cited in the various sections of this contract. Submit the GPV and TPC sustainability documentation required in this section as "S" submittals in all affected UFGS Sections.

- 1. Highlight GPV and TPC] compliance data in "S" submittal.
- 2. Add "S" submittals to the Sustainability eNotebook only after submittal approval, and bookmark them as required in paragraph SUSTAINABILITY ENOTEBOOK below.
- 3. Ensure all approved "S" submittals are included in each Sustainability eNotebook submittal.
- C. Sustainability eNotebook

The Sustainability eNotebook is an electronic organizational file that serves as a repository for all required sustainability submittals. To support documentation of compliance with an approved HPSB and TPC checklist, provide and maintain a comprehensive and current Sustainability eNotebook. Include all required data in Sustainability eNotebook, to support full compliance with the HPSB Guiding Principles Requirements, including:

- 1. HPSB checklist
- 2. Sustainability Action Plan
- 3. Calculations
- 4. Labels
- 5. "S" submittals
- 6. Certifications, assessments, or validations and compliance report
- 7. TPC documentation required in paragraph THIRD PARTY CERTIFICATION (TPC).
 - a. Sustainability eNotebook Format

Provide Sustainability eNotebook in the form of an Adobe PDF file; bookmark each HPSB Guiding Principles Requirement, TPC requirement, and sub-bookmark at each document. Match format to HPSB Guiding Principles numbering system indicated herein. Maintain up-to-date information, such as spreadsheets, templates, with each current submittals. For TPC projects, provide a second Table of Contents using TPC numbering system, for maintaining documentation unique to TPC. Project Manager may deduct from the monthly progress payment accordingly if Sustainability eNotebook information is not current and on track per project goals.

b. Sustainability eNotebook Submittal Schedule

Provide Sustainability eNotebook Submittals at the following milestones of the project:

1) Preliminary Sustainability eNotebook

Submit preliminary Sustainability eNotebook with updated Preliminary High Performance and Sustainable Building Checklist and TPC checklist at the first post award meeting in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

- 2) Interim Design Sustainability eNotebook Submit updated Sustainability eNotebook with updated Interim Design High Performance and Sustainable Building Checklist with TPC Checklist with the final design. If issues relating to achieving the sustainability goals of the project are subsequently identified, identify reasons and mitigation from DOR, and resubmit to the Project Manager for approval.
- 3) Final Design Sustainability eNotebook Submit updated Sustainability eNotebook with updated Final Design High Performance and Sustainable Building Checklist with TPC Checklist with the final design. If issues relating to achieving the sustainability goals of the project are subsequently identified, identify reasons and mitigation from DOR, and resubmit to the Project Manager for approval.
- 4) Third Party Certification Design Compliance Report Obtain Third Party Certification Design Compliance Report after final design submittal is approved. Submittal must indicate 100 percent compliance with applicable design requirements. File approved submittal in the Sustainability eNotebook.
- Construction Quality Control Meetings.
 Provide up-to-date GP and TPC documentation in the Sustainability eNotebook and TPC Online tool for each meeting.
- 6) Final Sustainability eNotebook

Submit updated Sustainability eNotebook with updated Final High Performance and Sustainable Building Checklist with TPC Checklist, at Substantial Completion Date (SCD). Final progress payment retainage may be held by Project Manager until Final Sustainability construction phase documentation is complete.

7) Amended Final Sustainability eNotebook

Amend and resubmit the Amended Final Sustainability eNotebook with Amended Final High Performance and Sustainable Building Checklist and amended TPC Checklist, to include postoccupancy corrections, updates, and requirements. Final progress payment retainage may be held by Project Manager until amended final sustainability documentation is complete. Submit the Amended Final Sustainability eNotebook Submittal on DVDs to the Project Manager no later than 30 days after final GP, TPC determination.

1.6 DOCUMENTATION REQUIREMENTS

- A. Incorporate each of the following HPSB Guiding Principles requirements into project and provide documentation that proves compliance with each listed requirement. Items below are organized by HPSB Guiding Principles. For life-cycle cost analysis requirements, one document with all analyses is acceptable, with Project Manager approval.
- B. For each of the following paragraphs that require the use of products listed on Owner-required websites, provide documentation of the process used to select products, or process used to determine why listed products do not meet project performance requirements.
- C. Integrated Design Process For the submittal documentation below, demonstrate compliance with UFC 1-200-02.
 - 1. Design Submittal Documentation
 - a. List the sustainability integrated design team, and a description of their roles in all stages of a project's planning and delivery:
 - (1) Include Contractor's Sustainability Coordinators; Architecture and Engineering disciplines involved on the project, and the DOR in charge of the overall project and each discipline; Construction Subcontractors and the company representatives that align with each architectural and engineering discipline, Planning, Public Works, Environmental Specialist and other appropriate installation personnel.
 - (2) Describe their roles and responsibilities and plan-of-action for how each team member will be involved to achieve the project sustainability requirements, and how the Contractor will coordinate with Owner personnel.
 - (3) Maintain an up-to-date list with descriptions throughout the project.
 - b. Provide narratives that:
 - Indicate performance goals for siting, energy, water, materials, and indoor environmental quality along with other comprehensive design goals and ensures incorporation of these goals throughout the design and life cycle of the building.
 - (2) Demonstrate integration of the goals into design and construction.
 - (3) Demonstrate collaboration with other providers, such as Commissioning Authority and Third Party Certification.
- D. Commissioning (Cx)

Develop and incorporate Commissioning requirements into the documents, in accordance with Section 01 91 15 TOTAL BUILDING COMMISSIONING.

E. Optimize Energy Performance

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

- 1. Design Submittal Documentation
 - a. Narrative that provides a summary of:
 - (1) The decision-making process leading to the selection of at least three energy-efficient solutions (for each system contributing to the energy footprint of the building) to be analyzed; and the selected design solution(s)
 - (2) The specific energy standard and version utilized; and the software used in the analysis
 - (3) The calculated energy consumption and energy use intensity (EUI in kBTU/sf/yr) of the baseline building and the proposed design alternatives
 - b. A minimum of the following energy modeling files and summaries for the baseline and proposed alternatives:

4

(1) Input, schedules and libraries; and output

- (2) Calculated energy use by energy type
- (3) Calculated energy use by building system
- c. The life-cycle cost analysis input and output files for the baseline and the proposed alternatives
- 2. Construction Submittal Documentation
- Provide revised energy modeling for actual system constructed.
- D. Energy Efficient Products

Provide only energy-using products that are Energy Star rated or have Federal Energy Management Program (FEMP) recommended efficiency. Where Energy Star or FEMP recommendations have not been established, provide most efficient products that are life-cycle cost-effective. Provide only energy using products that meet FEMP requirements for low standby power consumption. Energy efficient products can be found at: https://www.energy.gov/eere/femp/federal-energy-management-program and <a href="https://www.energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/femp/federal-energy.gov/eere/fem

E. On-site Renewable Energy Generation

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

- 1. Design Submittal Documentation
 - Provide life-cycle cost analysis (LCCA). When found to be LCCE, do one of the following options:
 - a. Provide design drawings and calculations that demonstrate total on-site renewable energy as an annual percentage of proposed building energy consumption in kBTU/year; and provide equipment ratings, and calculations that demonstrate the generation capacity of the system in kBTU/year for thermal and kwh for electricity.
 - b. Provide documentation that renewable energy development at the Installation level is planned.
- F. Solar Domestic Hot Water (SDHW)
 - For the submittal documentation below, demonstrate compliance with UFC 1-200-02.
 - 1. Design Submittal Documentation

Provide life-cycle cost analysis (LCCA). When found to be LCCE, provide design drawings and calculations that demonstrate total on-site renewable energy as an annual percentage of proposed building energy consumption in kBTU/year; and provide equipment ratings, and calculations that demonstrate the generation capacity of the system in kBTU/year for thermal.

G. Building-level Power Metering

Provide building-level meters for electricity, natural gas, and steam where applicable.

- 1. Design Submittal Documentation Provide design drawings that highlight meter locations on the site.
- 2. Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

H. Indoor Water Use

Provide Construction Documentation proof that fixtures are labeled EPA WaterSense, for products available with EPA WaterSense labeling; for all other fixtures, proof they comply with EPA WaterSense efficiency requirements.

I. Indoor Water Metering

Provide building-level meters for potable water use. Provide the requirements cited in the following paragraphs:

1. Design Submittal Documentation

Provide design drawings that highlight meter locations on the site.

2. Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

J. Outdoor Water Use

Where new irrigation is required, provide only non-potable sources. Provide the requirements cited in the following paragraphs:

- 1. Design Submittal Documentation
 - a. Provide design drawings and analysis that identify the non-potable water source used and demonstrate the non-potable water source is appropriate for landscape irrigation.
 - b. Provide life-cycle cost analysis (LCCA).

2. Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

K. Outdoor Water Meters

Provide meters for outdoor systems that use potable water. Provide the requirements cited in the following paragraphs:

- 1. Design Submittal Documentation
 - a. Provide design drawings that highlight meter locations on the site.
 - b. Provide life-cycle cost analysis (LCCA).
- 2. Construction Submittal Documentation
 Provide manufacturer's data validating compatibility with base with

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

L. Alternative Water

Use alternative sources of water to replace potable water usage, when life-cycle cost-effective and to the extent permitted by local laws and regulations.

- 1. Design Submittal Documentation
 - a. Provide design drawings and calculations that demonstrate the alternative water sources used, potable water savings as compared to non-alternative water sourcing and projected annual potable water savings.
 - b. Provide life-cycle cost analysis (LCCA).
- M. Stormwater Management Develop and incorporate stormwater requirements into the documents. Submit design and construction documentation required by UFC 3-210-10 and Service processes, as proof of this tracking requirement.
- N. Ventilation and Thermal Comfort

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

1. Design Submittal Documentation

Provide design drawings and calculations that demonstrate HVAC systems and the building envelope have been designed to meet the requirements.

O. Daylighting

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

- 1. Design Submittal Documentation
 - a. Provide floor plans and elevations.
 - b. Provide design analysis delineating requirements, to include compliant reflective surface locations and shading devices (where applicable).
- P. Moisture Control

Provide the following:

1. Design Submittal Documentation

Provide drawings of building envelope details and HVAC humidity controls.

Construction Submittal Documentation
 Ensure construction materials are separated and protected in accordance with other sections in this
 contract document, with adequate humidity controls during construction. In accordance with Section 01
 78 23 OPERATION AND MAINTENANCE DATA, includes plan for ongoing building moisture control.

 Q. Reduce Volatile Organic Compounds (VOC) (Low-Emitting Materials) Meet the requirements of Table 3-1 at the end of this specification. For Construction submittal documentation, provide certifications or labels that demonstrate compliance with cited requirements, based on the attached TABLE 3-1.

R. Indoor Air Quality During Construction

Prior to construction, create indoor air quality plan. Develop and implement an IAQ construction management plan during construction and flush building air before occupancy.

For new construction and for renovation of unoccupied existing buildings, meet the requirements of ICC IgCC 1001.3.1.5 (10.3.1.4) Indoor Air Quality (IAQ) Construction Management. For renovation of occupied existing buildings, meet the requirements of ANSI/SMACNA 008 IAQ Guidelines for Occupied Buildings Under Construction.

Provide documentation showing that after construction ends and prior to occupancy, HVAC filters were replaced and building air was flushed out in accordance with the cited standard.

S. Recycled Content

Comply with 40 CFR 247. Refer to: <u>https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program</u> for assistance identifying products cited in 40 CFR 247. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements.

- 1. Construction Submittal Documentation
 - a. Provide manufacturers' documents stating the recycled content by material, or written justification for claiming one of the exceptions allowed on the cited website.
 - b. Substitutions: Submit for Owner approval for proposed alternative products or systems that provide equivalent performance and appearance and have greater contribution to project recycled content requirements. For all such proposed substitutions, submit with the Sustainability Action Plan accompanied by product data demonstrating equivalence.
 - c. In order to complete compliance with Estimate of Percentage of Recovered Material Content for EPA Designated Items, refer to submittal requirement for recycled/recovered material content in Section 01 78 00 CLOSEOUT SUBMITTALS.
- T. Bio-Based Products

Provide products and materials composed of the highest percentage of bio-based materials (including rapidly renewable resources and certified sustainably harvested products), consistent with FSRIA 9002 USDA BioPreferred Program, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user and when available at a reasonable cost. Use only supplies and materials of a type and quality that conform to applicable specifications and standards. Comply with FSRIA 9002 USDA BioPreferred Program. Refer to <u>www.biopreferred.gov</u> for the product categories and BioPreferred Catalog. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements. Provide the following documentation:

- 1. USDA BioPreferred label for each product; for bio-based products used on project but not listed with BioPreferred program, provide bio-based content and percentage.
- 2. In order to complete compliance with Biobased Product Certification, refer to submittal requirement for biobased products in Section 01 78 00 CLOSEOUT SUBMITTALS, paragraphs CERTIFICATION OF EPA DESIGNATED ITEMS and CERTIFICATION OF USDA DESIGNATED ITEMS.
- U. Waste Material Management (Recycling Design)
 For the submittal documentation below, demonstrate compliance with UFC 1-200-02.
 For design submittal documentation, provide drawing showing an appropriately sized and placed dedicated storage area for recyclables.
- Waste Material Management (Recycling Construction)
 Divert demolition and construction debris in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
- W. Address Climate Change Risk For design submittal documentation, provide narrative of decisions for design associated with scoped requirements.
- X. Additional Sustainability Requirements

Provide the additional sustainability requirements cited in this paragraph.

- Third Party Certification (TPC) Documentation Third Party Certification certificate, assessment, or validation, and compliance report requirements are in addition to all requirements under header above GUIDING PRINCIPLES VALIDATION (GPV).
 - a. TPC Registration Required Register and achieve Third Party Certification (TPC), by meeting all TPC and project requirements to achieve LEED v4 BD+C. Third Party Certification is met when Owner receives TPC organization certificate, assessment, or validation and compliance report and plaque]. Register project with TPC organization using the following format and content:
 - 1) Project Title First Line: Building Owner (SDDOM), Building Name (if known)
 - 2) Project Title Second Line: MILCON P#, DD1391 Project Name
 - 3) Project Address: UIC (Installation code), Category code, RPUID (Real Property Unique Identifier) Number
 - 4) Project Owner Organization: SDARNG
 - 5) Primary Contact, Project Owner: Project Manager or Engineering Manager
 - 6) Building Owner Organization: Dept. of the Military
 - 7) Building Owner Organization: State of South Dakota

- 8) Project Number
- b. TPC Management and Certification

Execute the following TPC Certification, assessment, or validation requirements:

- 1) Refer to TPC Checklist at the end of this specification section. (Multiple checklists indicate multiple buildings that require TPC.)
- 2) Immediately bring to the attention of the Project Manager any project changes that impact meeting the approved TPC Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.
- 3) Complete all design and construction work to incorporate the applicable TPC Requirements.
- 4) Maintain the design and construction related information in the Sustainability eNotebook pertaining to additions and changes to the approved sustainability requirements. Maintain the Sustainability eNotebook in electronic format. Refer to explanation in the paragraph SUSTAINABILITY eNOTEBOOK. Provide the following components in the Sustainability eNotebook, in addition to the GPV components listed above:
 - a) TPC Checklist
 - b) Completed TPC forms. Transmit by the method required by TPC organization.
 - c) Copy of all correspondence with the TPC organization. Provide proof of TPC registration.
 - d) Documentation illustrating compliance with TPC requirements and additional documentation as requested by the Third Party certifier.
 - e) TPC Award Certificate, assessment or validation and compliance report.
- 5) Provide the following information in the Sustainability Action Plan. Provide this TPC information in addition to the Sustainability Action Plan items above:
 - a) Planned method to achieve each TPC requirement.
 - b) Provide analysis of each TPC credit and how project will comply.
 - c) Provide names and contact information for: Contractor sustainability point of contact (POC) and other names of sustainability professionals on the Contractor's Staff responsible for ensuring TPC sustainability goals are accomplished and documentation is assembled.

6) Bear all costs associated with designing, constructing, demonstrating, and documenting that project complies with approved TPC requirements, including but not limited to:

- a) Registration, review, certification, assessment, or validation and plaque] fees.
- b) Online (or offline with secure facilities) TPC management and documentation.
- c) Obtaining TPC certification, assessment, or validation based on Owner-approved sustainability goals.
- d) Design and construction work required to incorporate TPC requirements.
- e) Submittals required to demonstrate compliance with Owner approved TPC checklists.
- 7) Provide all design data, calculations, product data, and certifications, assessments, or validations required in this specification to demonstrate compliance with the TPC Requirements.
- 8) Provide all online (or offline, with secure facilities) TPC management and documentation. Provide all required responses to third party organization.
- Facilitate and participate in required TPC site visit. Coordinate with the Executing DOD Service's Project Manager and Design Manager, to determine participating team members. Include Commissioning provider on applicable projects.
- 10) Provide TPC Plaque and Certificate, assessment, or validation. Provide TPC compliance report that includes level achieved and reasons for non-compliance or not applicable elements. Use the following format to create the Plaque, Certificate, assessment, or validation, compliance report, and Letter of Congratulations. Forward to parties designated by Project Manager:
 - a) Plaque:
 - b) Name: Final Building Name. If unknown, use the Form DD1391 Project Name.
 - c) Certificate, Assessment, or Validation:
 - d) Project title, first line: P-(X); (1391 Project Name). Project title, second line: UIC (installation code)
 - e) Letter of Congratulation (when provided):
 - f) Address letter to the Facility's Installation Commander Name. Address the letter to an individual person.
 - g) Compliance Report:
 - h) Title page must cite Project title: P-(X); (1391 Project Name); Final Building Name if known; UIC (installation code); Owner Service; User organization if known; date of compliance.

- i) Include TPC scoresheet if applicable.
- 2. Third Party Certification (TPC) Documentation

Third Party Certification certificate, assessment, or validation, and compliance report requirements are in addition to all requirements under header above GUIDING PRINCIPLES VALIDATION (GPV).

a. TPC Registration

This project has been designed for and must be constructed to achieve **LEED v4 BD+C Silver Certification.** Project is already registered with the TPC Organization. Provide construction related sustainability documentation, in the format required by the TPC Organization, to the Project Manager for approval, and for final approval by the TPC organization. Third Party Certification is met when Owner receives TPC organization certificate, assessment, or validation and compliance report and plaque. Execute the following:

- a. Refer to TPC Checklist at the end of this specification section. (Multiple checklists indicate multiple buildings that require TPC.)
- b. Immediately bring to the attention of the Project Manager any project changes that impact meeting the approved TPC Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.
- c. Complete all work required to incorporate the applicable TPC Requirements.
- Maintain the construction related information in the Sustainability eNotebook pertaining to additions and changes to the approved sustainability requirements. Maintain the Sustainability eNotebook in electronic format. For more explanation, refer to paragraph SUSTAINABILITY eNOTEBOOK. Provide the following components in the Sustainability eNotebook, in addition to the GPV components above:
 - (1) TPC Checklist
 - (2) Provide construction documentation required to achieve third party certification
- e. Provide the following information in the Sustainability Action Plan. Provide this TPC information in addition to the GPV Action Plan items above:
 - (1) Planned method to achieve each TPC requirement.
 - (2) For each TPC requirement that is attempted but not achieved, provide narrative explaining how mission or activity precludes achieving specific sustainability requirement or goal. Provide analysis of particular requirement and level to which project is able to comply.
 - (3) Provide name and contact information for: Sustainability Point of Contact (POC) and other names of sustainability professionals responsible for ensuring TPC sustainability goals are accomplished and documentation is assembled. Sustainability POCs are also responsible for ensuring GPV required in paragraph GUIDING PRINCIPLES VALIDATION (GPV) above.
- f. Bear all costs associated with construction changes that affect sustainability design requirements, constructing, demonstrating, and documenting that project complies with approved TPC requirements, including but not limited to:
 - (1) TPC coordination with Owner's AE and other consultants, TPC website requirements, and management for construction related documentation.
 - (2) Construction work required to incorporate TPC requirements.
 - (3) Submittals required to demonstrate compliance with Owner approved TPC checklists.
 - (4) Documentation illustrating compliance with TPC requirements and additional documentation required by the TPC.
- g. Provide all calculations, product data, and certifications, assessments, or validations required in this contract to demonstrate compliance with the TPC Requirements of this section.
- Third Party Certification (TPC) Documentation Third Party Certification certificate, assessment, or validation, and compliance report requirements are in addition to all requirements under header above GUIDING PRINCIPLES VALIDATION (GPV).
 - a. TPC Registration Required Pay all fees associated with registration and achievement of Third Party Certification (TPC), by meeting all TPC and project requirements to achieve LEED v4 BD+C Silver Certification. Third Party Certification is met when Owner receives TPC organization certificate, assessment, or validation and compliance report and plaque.

Register project with TPC organization using the following format and content:

- 1) Project Title First Line: Building Owner (SD DOM), Building Name (if known)
- 2) Project Title Second Line: MILCON P#, DD1391 Project Name

- 3) Project Address: UIC (Installation code), Category code, RPUID (Real Property Unique Identifier) Number
- 4) Project Owner Organization: SDARNG
- 5) Primary Contact, Project Owner: Project Manager
- 6) Building Owner Organization: State of South Dakota
- 7) Building Owner Organization Project Number
- b. TPC Already Registered

Project is already registered with TPC organization to achieve LEED v4 BD+C Silver Certification. When applicable, request TPC online access turnover from Owner. Manage and provide all documentation for requirements of TPC and obtain Final Certification or validation. Third Party Certification is met when Owner receives TPC organization certificate, assessment, or validation and compliance report and plaque.

- c. TPC Management and Certification
 - Execute the following TPC Certification, assessment, or validation requirements:
 - 1) Refer to TPC Checklist at the end of this specification section. (Multiple checklists indicate multiple buildings that require TPC.)
 - 2) Immediately bring to the attention of the Project Manager any project changes that impact meeting the approved TPC Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.
 - 3) Complete all work required to incorporate the applicable TPC Requirements.
 - 4) Maintain the construction related information in the Sustainability eNotebook pertaining to additions and changes to the approved sustainability requirements. When construction changes are made that affect design sustainability requirements, provide all required updates to affected design requirements and update in the Sustainability eNotebook. Maintain the Sustainability eNotebook in electronic format. For more explanation, refer to paragraph SUSTAINABILITY eNOTEBOOK. Provide the following components in the Sustainability eNotebook, in addition to the GPV components above:
 - a) TPC Checklist
 - b) Completed TPC forms. Transmit by the method required by the TPC organization.
 - c) Copy of all correspondence with the TPC organization including proof of TPC registration
 - d) Documentation illustrating compliance with TPC requirements and additional documentation as requested by the TPC
 - e) TPC Award Certificate, assessment, or validation and compliance report.
- e. Provide the following information in the Sustainability Action Plan. Provide this TPC information in addition to the Sustainability Action Plan items above:
 - 1) Planned method to achieve each TPC requirement.
 - For each TPC requirement that is attempted but not achieved, provide narrative explaining how mission or activity precludes achieving specific sustainability requirement or goal.
 Provide analysis of particular requirement and level to which project is able to comply.
 - 3) Provide name and contact information for: Sustainability point of contact (POC) and other names of sustainability professionals responsible for ensuring TPC sustainability goals are accomplished and documentation is assembled. Sustainability POCs are also responsible for ensuring GPV required in paragraph GUIDING PRINCIPLES VALIDATION (GPV) above.
- f. Bear all costs associated with construction changes that affect sustainability design requirements, constructing, demonstrating, and documenting that project complies with approved TPC requirements, including but not limited to:
 - 1) Final TPC review, certification, assessment, or validation[and plaque] fees.
 - 2) Online (or offline with secure facilities) TPC management and documentation.
 - 3) Obtaining TPC certification or validation based on Owner-approved sustainability goals.
 - 4) Construction work required to incorporate TPC requirements.
 - 5) Submittals required to demonstrate compliance with Owner approved TPC checklists.
- g. Provide all calculations, product data, and certifications, assessments, or validations required in this specification to demonstrate compliance with the TPC Requirements.
- h. Provide all TPC management and documentation. Transmit TPC requirements by the method required by TPC organization.
- i. Provide all required responses to third party organization.

- j. Facilitate and participate in required TPC site visit. Coordinate with the Project Manager to determine participating team members. Include Commissioning provider on applicable projects.
- k. Provide TPC Plaque and Certificate, assessment, or validation. Provide TPC compliance report that includes level achieved and reasons for non-compliance or not applicable elements. Use format below to create the Plaque, Certificate, assessment or validation, compliance report, and Letter of Congratulations (when provided). Forward to parties designated by Project Manager:
 - 1) Plaque: Name: Final Building Name. If unknown, provide Form DD1391 Project Name.
 - Certificate, Assessment or Validation: Project Title, first line: P-(X); Form DD1391 Project Name). Project Title, second line: UIC (Installation code)
 - 3) Compliance Report:

Title page must cite Project title: P-(X); (1391 Project Name); Final Building Name if known; UIC (installation code); Owner Service; User organization if known; date of compliance. Include TPC scoresheet if applicable.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 SUSTAINABILITY COORDINATION

Provide sustainability focus and coordination at all meetings to achieve sustainability goals. Coordinate meeting requirements with other UFGS Sections meeting requirements in this project. Ensure the designated TPC accredited sustainability professional responsible for GP and TPC documentation participates in these meetings to coordinate documentation completion. Review GP and TPC sustainability requirements, HPSB Checklist and TPC documentation, Sustainability Action Plan, and completeness status of Sustainability eNotebook, and TPC status at the following meetings:

- A. Pre-Construction Conference
- B. Construction Quality Control Meetings
- C. Refer to Section 01 30 00 ADMINISTRATIVE PROCEDURES for Post Award Meetings.
 - 1. Post Award Meeting
 - 2. Design Quality Assurance Meetings
 - 3. Design Complete Review Meetings
- D. Conduct review no later than 60 days after final design complete submission and identify any outstanding issues that affect correct completion of all documentation requirements, and actions that will achieve requirements. Conduct corrective actions.
- E. TPC On-site Visit
- F. Execute, coordinate, and facilitate on-site visit by third party representative no later than 60 days before final turnover, or as required by TPC organization, whichever is greater.
- G. Facility Turnover Meetings
- H. Conduct review no later than 60 days before final turnover and identify any outstanding issues that affect correct completion of all documentation and final TPC certification, assessment or validation, and actions that will achieve requirements. Conduct corrective actions prior to turnover, to ensure all requirements are achieved.

3.02 THIRD PARTY CERTIFICATION CERTIFICATE, ASSESSMENT, OR VALIDATION AND COMPLIANCE REPORT Finalize the process requirements and obtain the TPC Plaque and Certificate, assessment, or validation, and compliance report, indicating completion of the project's sustainability goals. Include TPC compliance report with final TPC scoresheet as applicable.

Provide and hang Plaque in accordance with contract documents. Provide one original framed copy of the certificate, assessment, or validation, mounted in 1-inch-deep metal frames, with double matt, and wire hangers, in location approved by Project Manager. Deliver one original certificate, assessment, or validation, and compliance report to Project Manager, unless otherwise instructed. Provide and hang Plaque in a prominent interior location approved by the Project Manager.

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01 35 26 SAFETY REQUIREMENTS

PART 1 – GENERAL

SUMMARY 1.1

C.

The following section outlines minimum safety requirements to be followed by the Contractor. The Contractor is responsible to development, posting, training, and compliance of an Accident Prevention Plan. Contractor shall

1.2 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

В.	American Society of Mechani	cal Engineers (ASME)
	B30.3	Tower Cranes
	B30.7	Winches
	B30.9	Slings
	B30.20	Below-the-Hook Lifting Devices
	B30.22	_Articulating Boom Cranes
	B30.23	Personnel Lifting Systems Safety Standard for Cableways, Cranes, Derricks,
		Hoists, Hooks, Jacks, and Slings
	B30.26	Rigging Hardware
C.	American Society of Safety En	gineers (ASSE):
	A10.1-2011	Pre-Project & Pre-Task Safety and Health Planning
	A10.34-2012	Protection of the Public on or Adjacent to Construction Sites
	A10.38-2013	Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations
	A10.44	Control of Energy Sources (Lockout/Tagout) for Construction and Demolition
		Operations
	Z359.1	The Fall Protection Code
	Z359.2	Minimum Requirements for a Comprehensive Managed Fall Protection
		Program
	ASSP Z359.3	Safety Requirements for Lanyards and Positioning Lanyards
	ASSP Z359.4	Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
	ASSP Z359.6	Specifications and Design Requirements for Active Fall Protection Systems
	ASSP Z359.7	Qualification and Verification Testing of Fall Protection Products
	ASSP Z359.11	Safety Requirements for Full Body Harnesses
	ASSP Z359.12	Connecting Components for Personal Fall Arrest Systems
	ASSP Z359.13	Personal Energy Absorbers and Energy Absorbing Lanyards
	ASSP Z359.14	Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and
		Rescue Systems
	ASSP Z359.15	Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
	ASSP 7359.16	Safety Requirements for Climbing Ladder Fall Arrest Systems
	ASSP Z359.18	Safety Requirements for Anchorage Connectors for Active Fall Protection
		Svstems
	ASSP 7490 1	Criteria for Accepted Practices in Safety, Health, and Environmental
		Training
P	American Society for Testing	and Materials (ASTM)
υ.		Standard Specifications for Temporary Protective Grounds to Be Used on De-
_		energized Electric Power Lines and Equipment
E.	National Fire Protection Asso	Ciation (NFPA):
	10	Standard for Portable Fire Extinguishers
	30	Flammable and Combustible Liquids Code
	518	Standard for Fire Prevention during Welding, Cutting and Other Hot Work
	70	National Electrical Code
	70B	Recommended Practice for Electrical Equipment Maintenance

- F. Manual of Uniform Traffic Control Devices
- G. Occupational Safety and Health Administration (OSHA):
 - All Sections
 - 29 CFR 1904 Reporting and Recording Injuries & Illnesses
 - 29 CFR 1910 Safety and Health Regulations for General Industry
 - 29 CFR 1926 Safety and Health Regulations for Construction Industry
 - CPL 2-0.124..... Multi-Employer Citation Policy
- H. Telecommunications Industry Association (TIA)

1.3 DEFINITIONS:

- A. *Critical Lift*. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.
- B. **OSHA "Competent Person" (CP)**. One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).
- C. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- D. *High Visibility Accident*. Any mishap which may generate publicity or high visibility.
- E. Accident/Incident Criticality Categories:

No Impact – near miss incidents that should be investigated but are not required to be reported; Minor incident/impact – incidents that require first aid or result in minor equipment damage (less than \$5000). These incidents must be investigated and shall be reported;

Moderate Incident/Impact – These incidents must be investigated and are required to be reported. These include any work-related injury or illness that results in:

- 1. Days away from work (any time lost after day of injury/illness onset);
- 2. Restricted work;
- 3. Transfer to another job;
- 4. Medical treatment beyond first aid;
- 5. Loss of consciousness;
- 6. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,
- 7. Any incident that leads to major equipment damage (greater than \$5000).

Major Incident/Impact – Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than \$20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported as soon as practical, but not later than 2 hours after the incident.

E. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.4 REGULATORY REQUIREMENTS:

- A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations.
- B. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Project Manager and SDARNG SOHO.

1.5 ACCIDENT PREVENTION PLAN (APP):

- A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific.
- B. The Prime Contractor is considered to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.
- C. The APP shall be prepared as follows:
 - 1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the project. Specifically articulating the safety requirements found within these contract safety specifications.
 - 2. Address both the Prime Contractors and the subcontractors work operations.
 - 3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
 - 4. Address all the elements/sub-elements and in order as follows:
 - a. **SIGNATURE SHEET** Title, signature, and phone number of the following:
 - 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
 - 2) Plan approver (company/corporate officers authorized to obligate the company);
 - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional).
 - b. BACKGROUND INFORMATION List the following:
 - 1) Contractor;
 - 2) Project name;
 - 3) Contract number;
 - 4) Brief project description, description of work to be performed, and phases of work anticipated.
 - c. STATEMENT OF SAFETY AND HEALTH POLICY
 - 1) Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees.
 - d. **RESPONSIBILITIES AND LINES OF AUTHORITIES**. Provide the following:
 - 1) Statement of the employer's ultimate responsibility for the implementation of the SOH program;
 - Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes;
 - 3) Names of Competent and Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached;
 - 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
 - 6) Lines of authority;
 - 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. SUBCONTRACTORS AND SUPPLIERS

Provide procedures for coordinating SOH activities with other employers on the job site:

- 1) Identification of subcontractors and suppliers (if known);
- 2) Safety responsibilities of subcontractors and suppliers.
- f. TRAINING
 - 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
 - 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc.) and any requirements for periodic retraining/recertification are required.
 - 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
 - 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. ACCIDENT/INCIDENT INVESTIGATION & REPORTING

The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure and identify person(s) responsible to provide the following to the Project Manager:

- 1) Exposure data (man-hours worked);
- 2) Accident investigation reports;
- 3) Project site injury and illness logs.

h. PLANS (PROGRAMS, PROCEDURES) REQUIRED

Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

- 1) Emergency response;
- 2) Contingency for severe weather;
- 3) Fire Prevention;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);
- 8) Hazard communication program;
- 9) Welding/Cutting "Hot" work;
- 10) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 11) General Electrical Safety;
- 12) Site-Specific Fall Protection & Prevention;
- 13) Excavation/trenching;
- 14) Asbestos abatement;
- 15) Crane Critical lift;
- 16) Respiratory protection;
- 17) Health hazard control program;
- 18) Heat/Cold Stress Monitoring;
- 19) Demolition plan (to include engineering survey);
- 20) Formwork and shoring erection and removal;
- 21) PreCast Concrete;
- 22) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).
- D. Submit the APP to the Project Manager for review of compliance with contract requirements. Work cannot proceed without an accepted APP.
- E. Once accepted by the Project Manager, the APP and attachments will be enforced as part of the contract.
- F. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Project Manager.

1.6 ACTIVITY HAZARD ANALYSES (AHA):

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site).
- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.
- C. Work shall not begin until the AHA for the work activity has been accepted by the Project Manager and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and on-site representatives at preparatory and initial control phase meetings.

1.7 PRECONSTRUCTION CONFERENCE:

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

- 1.8 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):
 - A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan.
 Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.
 - B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
 - C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
 - D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
 - E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee.

1.9 TRAINING:

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or have a safety and health degree from an accredited university or college.
- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Project Manager for review of compliance upon request.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of equipment, emergency procedures, accident reporting etc. Documentation shall be provided to the Project Manager that individuals have undergone contractor's safety briefing.
- G. Ongoing safety training will be accomplished in the form of every other week documented safety meeting.

1.10 INSPECTIONS:

A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work operations as required by 29 CFR 1926.20(b)(2).

1.11 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

A. The prime contractor shall establish and maintain an accident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damages that occur on site. Notify the Project Manager as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incidents, High Visibility Incidents, or any weight handling and hoisting equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.).

- B. Conduct an accident investigation for all Minor, Moderate and Major Incidents as defined in the paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete and provide the report to the Project Manager within 5 calendar days of the accident. The Project Manager will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Project Manager monthly.
- D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Project Manager monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Project Manager as requested.

1.12 PERSONAL PROTECTIVE EQUIPMENT (PPE):

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
 - 1. Hard Hats unless written authorization is given by the SSHO in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
 - 2. Safety glasses unless written authorization is given by the SSHO in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
 - 3. Appropriate Safety Shoes based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by SSHO in circumstances of no foot hazards.
 - 4. Hearing protection Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.
 - 5. Should the SSHO provide written authorization to not use PPE as noted above, documentation must be provided to the Project Manager within 24 hours.

1.13 FIRE SAFETY

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Project Manager for record keeping. This plan may be an element of the APP.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 20 feet exposing overall length, separate by 10 feet.
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Project Manager.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Project Manager.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Request interruptions with Project Manager. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested. Parameters for the testing and results of any tests performed shall be recorded and copies provided to the Project Manager.
- M. Smoke Detectors: Prevent accidental operation. Install temporary covers to prevent activation and contamination. Remove temporary covers at end of work operations each day. Coordinate with Project Manager and SD Dept. of the Military Fire & Emergency Services Manager.
- N. Hot Work:

- 1. Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Project Manager and SD Dept. of the Military Fire & Emergency Services Manager.
- 2. Obtain permits from SD Dept. of the Military Fire & Emergency Services Manager at least 72 hours in advance.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Project Manager.
- P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

1.14 ELECTRICAL

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.
- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.
- C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination.

1.15 FALL PROTECTION

- A. The fall protection (FP) threshold height requirement is 6 ft for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
 - 1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
 - 2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
 - 3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements).
 - 4. Fall protection while using a ladder will be governed by the OSHA requirements.

1.16 SCAFFOLDS AND OTHER WORK PLATFORMS

- A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.
- B. The fall protection (FP) threshold height requirement is 6 ft.
- C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
 - 1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
 - 2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
 - 3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
 - 4. Emergency descent devices shall not be used as working platforms.
- D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
 - 1. The Competent Person's name and signature;
 - 2. Dates of initial and last inspections.

1.17 EXCAVATION AND TRENCHES

- A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than 5 feet in depth require evaluation by the contractor's "Competent Person" (CP) for determination of the necessity of an excavation protective system where kneeing, laying in, or stooping within the excavation is required.
- C. As required by OSHA 29 CFR 1926.651(b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

- 1. The planned dig site will be outlined/marked in white prior to locating the utilities.
- 2. Use of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.
- 3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.
- 4. Digging will not commence until all known utilities are marked.
- 5. Utility markings will be maintained by the Contractor.
- D. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 3 to 5 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.
- E. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

1.18 CRANES

- A. All crane work shall comply with 29 CFR 1926 Subpart CC.
- B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date.
- C. A detailed lift plan for all lifts shall be submitted to the Project Manager 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted for review. The lift will not be allowed to proceed without prior acceptance of this document.
- D. Crane operators shall not carry loads
 - 1. Over the general public or personnel
 - 2. Over any occupied building unless
 - a. The top two floors are vacated;
 - b. Overhead protection with a design live load of 300 psf is provided.

1.19 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other requirements discussed in the section.

1.20 CONFINED SPACE ENTRY

- A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].
- B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Project Manager and SD Dept. of the Military Fire & Emergency Services Manager.

1.21 WELDING AND CUTTING

A. As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Project Manager. Obtain permits from SD Dept. of the Military Fire & Emergency Services Manager at least 72 hours in advance.

1.22 LADDERS

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders.
- D. Step Ladders shall not be used in the closed position.
- E. Top steps or cap of step ladders shall not be used as a step.
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
 - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

- 2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.23 FLOOR & WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.

- B. Floor and roof holes/openings are any that measure over 2 inches in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe-boards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
 - 1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
 - 2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
 - 3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
 - 4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
 - 5. Workers are prohibited from standing/walking on skylights.

PART 2 – PRODUCTS – NOT USED

2.1 CONFINED SPACE SIGNAGE

Provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs for confined spaces must comply with NEMA Z535.2. Provide signs with wording: "DANGER-- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" in bold letters a minimum of one inch in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" must be red and readable from 5 feet.

PART 3 - EXECUTION - NOT USED

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01 35 30 SECURITY REQUIREMENTS

PART 1 – GENERAL

1.1 SUMMARY

Included in this section are the Contractor's responsibilities to ensure construction sites and SDARNG property remain secure at all times during the construction process.

1.2 SECURITY

- A. Job site security is the responsibility of the Contractor. The Contractor shall take all necessary, prudent, and reasonable actions to secure the project site and the construction limits, including temporary enclosures and storage facilities, against unauthorized entry and theft. An equivalent security level and measures of the adjacent facility shall be maintained.
- B. The Contractor is advised current national "Force Protection Condition" (FPCON) ratings are applicable to all SDARNG facilities statewide. At any time the FPCON level may be increased to a heightened level requiring additional security measures.

Increased security levels may include, but are not limited to, limited personnel access, thorough entry screening of all personnel, random vehicle searches, parking limitations, and other measures may also be enforced. Cooperation with the Dept. of the Military and local SDARNG personnel with respect to FPCON issues is essential and compliance with FPCON measures directed are mandatory for the Prime Contractor, subcontractors, vendors, and suppliers, all employees of those entities, and any other person or persons having business regarding the work of the project who require access to the SDARNG facility.

FPCON measures directed and deemed necessary but which cause delay to the project or which have a negative impact upon the Prime Contractor's abilities to perform the work shall be subject to consideration as Changes in the Work in accordance with Article 14 of the General Conditions to <u>Agreement for Construction</u>.

1.3 FACILITY ACCESS

- A. The Contractor shall submit a SDARNG Contractor Access Application for the individual identified at the Contractor's Superintendent for the project. The Superintendent will be required to pass a background check for unescorted access to the SDARNG project site. The Contractor will be required to have a Superintendent that is able to pass a background check. The Superintendent must be onsite during all time's additional employees or Subcontractors are onsite. The Superintendent is ultimately responsible for all project site security and related issues.
- B. The Contractor shall submit an Employee Access List (EAL) identifying each employee's name and driver's license number or other form of government issued ID number. Only employees on the EAL will be permitted to work on the project site. This list must be kept current throughout the duration of the project. Employees entering the facility may be required to temporarily surrender a government-issued photo ID, such as a driver's license, to verify access clearance.
- C. The Dept. of the Military may, at its sole option, issue to the Contractor one or more proximity cards programmed to allow access to the facility. If such a card(s) is issued, the Contractor shall be responsible to assure only authorized employees utilize the card. The Contractor shall promptly notify the Dept. of the Military in the event the card is lost or damaged in a manner that it cannot be used. The Contractor shall pay \$5.00 for each lost or damaged card. All cards shall be returned to the Dept. of the Military upon completion of the project.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION – NOT USED

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01 42 00 SOURCES FOR REFERENCE PUBLICATIONS

PART 1 – GENERAL

1.1 SUMMARY

This section specifies organizations from which references and standards specified in the project manual are available.

1.2 REFERENCE ORGANIZATIONS

The specifications cited in this project manual and associated construction plans may be obtained from the associations or organizations listed below.

AACE	AACE INTERNATIONAL https://web.aacei.org/
ASA	ACOUSTICAL SOCIETY OF AMERICA https://acousticalsociety.org/
ABAA	AIR BARRIER ASSOCIATION OF AMERICA https://www.airbarrier.org/
ACCA	AIR CONDITIONING CONTRACTORS OF AMERICA https://www.acca.org/
ADC	AIR DUCT COUNCIL https://flexibleduct.org/
AMCA	AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. http://www.amca.org
AHRI	AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE http://www.ahrinet.org
ATIS	ALLIANCE FOR TELECOMMUNICATIONS INDUSTRY SOLUTIONS http://www.atis.org
AA	ALUMINUM ASSOCIATION https://www.aluminum.org/
AAMA	AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION https://aamanet.org/
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
	https://www.transportation.org/
AATCC	AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS https://www.aatcc.org/
ABMA	AMERICAN BEARING MANUFACTURERS ASSOCIATION https://www.americanbearings.org/
ACR	AMERICAN COLLEGE OF RADIOLOGY https://www.acr.org/
ACI	AMERICAN CONCRETE INSTITUTE https://www.concrete.org/
ACPA	AMERICAN CONCRETE PIPE ASSOCIATION https://www.concretepipe.org/
ACGIH	AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS https://www.acgih.org/
AFF	AMERICAN FOREST FOUNDATION https://www.treefarmsystem.org
AGA	AMERICAN GAS ASSOCIATION https://www.aga.org/
AGMA	AMERICAN GEAR MANUFACTURERS ASSOCIATION https://www.agma.org/
АНА	AMERICAN HARDBOARD ASSOCIATION http://domensino.com/AHA/
AIHA	AMERICAN INDUSTRIAL HYGIENE ASSOCIATION https://www.aiha.org/
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION https://www.aisc.org/
AITC	AMERICAN INSTITUTE OF TIMBER CONSTRUCTION http://www.aitc-glulam.org
AISI	AMERICAN IRON AND STEEL INSTITUTE https://www.steel.org/
ALI	AMERICAN LADDER INSTITUTE https://www.americanladderinstitute.org
ALSC	AMERICAN LUMBER STANDARDS COMMITTEE http://www.alsc.org
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE https://www.ansi.org/
API	AMERICAN PETROLEUM INSTITUTE https://www.api.org/
AREMA	AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION
	https://www.arema.org
ASNT	AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING https://www.asnt.org/
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS https://www.asce.org/
ASHRAF	AMERICAN SOCIETY OF HEATING REERIGERATING AND AIR-CONDITIONING ENGINEERS
	https://www.ashrae.org/
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS https://www.asme.org/
ASSP	AMERICAN SOCIETY OF SAFETY PROFESSIONALS https://www.assp.org/
ASSE	AMERICAN SOCIETY OF SANITARY ENGINEERING http://www.asse-plumbing.org
AWWA	AMERICAN WATER WORKS ASSOCIATION https://www.awwa.org/
AWS	AMERICAN WEI DING SOCIETY https://www.aws.org/
AWC	AMERICAN WOOD COUNCIL https://www.awc.org/
AWPA	AMERICAN WOOD PROTECTION ASSOCIATION http://www.awpa.com
AH	AmericanHort https://www.americanhort.org/
ΔΡΔ	APA - THE ENGINEERED WOOD ASSOCIATION https://www.apawood.org/
AABC	ASSOCIATED AIR BALANCE COLINCIL https://www.aphc.com/
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AEIC	ASSOCIATION OF EDISON ILLUMINATING COMPANIES https://aeic.org/
APSP	ASSOCIATION OF POOL & SPA PROFESSIONALS <u>https://apsp.org/</u>
ASTM	ASTM INTERNATIONAL <u>https://www.astm.org/</u>
AVIXA	AUDIOVISUAL AND INTEGRATED EXPERIENCE ASSOCIATION https://www.avixa.org/
BTL	BACNET INTERNATIONAL https://www.bacnetlabs.org/
BICSI	BICSI International Standards Program https://www.bicsi.org/
BIFMA	BIFMA INTERNATIONAL https://www.bifma.org/
внма	BUILDERS HARDWARE MANUFACTURERS ASSOCIATION https://www.buildershardware.com/
CRI	CARPET AND RUG INSTITUTE https://carpet-rug.org/
CISPI	CAST IRON SOIL PIPE INSTITUTE https://www.cispi.org/
CDC	CENTERS FOR DISEASE CONTROL AND PREVENTION https://www.cdc.gov
СРА	COMPOSITE PANEL ASSOCIATION https://www.compositepanel.org/
CAGI	COMPRESSED AIR AND GAS INSTITUTE https://www.cagi.org/
CGA	COMPRESSED GAS ASSOCIATION https://www.cganet.com/
CRSI	CONCRETE REINFORCING STEEL INSTITUTE http://www.crsi.org/
CFA	CONSUMER ELECTRONICS ASSOCIATION https://www.cta.tech/
CTI	COOLING TECHNOLOGY INSTITUTE https://www.coolingtechnology.org/
	COPPER DEVELOPMENT ASSOCIATION https://www.copper.org/
CEO	COUNCIL ON ENVIRONMENTAL OUALITY https://www.wbitebouse.gov/administration/eon/ceg
	CRANE MANUEACTURERS ASSOCIATION OF AMERICA http://www.wnitenouse.gov/administration/eop/ccq
	CSA GROUD https://www.csagroup.org/
	DOOP AND ACCESS SYSTEM MANULEACTUREDS ASSOCIATION https://www.docmo.com/
	ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION <u>Inteps://www.ecianow.org</u>
EIA	
ESD	ELECTROSTATIC DISCHARGE ASSOCIATION <u>https://www.esda.org/</u>
EIL	ETL TESTING LABORATORIES <u>http://www.intertek.com/</u>
EJMA	EXPANSION JOINT MANUFACTURERS ASSOCIATION http://www.ejma.org
EE	EXTRON ELECTRONICS <u>https://www.extron.com/</u>
FCI	FLUID CONTROLS INSTITUTE https://fluidcontrolsinstitute.org/
FSA	FLUID SEALING ASSOCIATION <u>www.fluidsealing.com</u>
FM	FM GLOBAL <u>https://www.fmglobal.com/</u>
FSC	FOREST STEWARDSHIP COUNCIL <u>https://us.fsc.org/</u>
FCCCHR	FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
	https://fccchr.usc.edu/
GSI	GEOSYNTHETIC INSTITUTE https://geosynthetic-institute.org/
GANA	GLASS ASSOCIATION OF NORTH AMERICA http://www.glasswebsite.com
GBCI	GREEN BUSINESS CERTIFICATION INC. https://www.gbci.org
GBI	GREEN BUILDING INITIATIVE https://www.thegbi.org/
GS	GREEN SEAL https://www.greenseal.org/
GA	GYPSUM ASSOCIATION https://www.gypsum.org/
HPVA	HARDWOOD PLYWOOD AND VENEER ASSOCIATION https://www.decorativehardwoods.org/
HI	HYDRAULIC INSTITUTE http://www.pumps.org
HYI	HYDRONICS INSTITUTE DIVISION OF AHRI <u>http://www.ahrinet.org</u>
ICC-ES	ICC EVALUATION SERVICE, INC. <u>https://icc-es.org/</u>
IES	ILLUMINATING ENGINEERING SOCIETY <u>https://www.ies.org/</u>
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS https://www.ieee.org/
IEST	INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY https://www.iest.org/
IICRC	INSTITUTE OF INSPECTION, CLEANING, AND RESTORATION CERTIFICATION https://www.iicrc.org/
ICEA	INSULATED CABLE ENGINEERS ASSOCIATION https://www.icea.net/
IGMA	INSULATING GLASS MANUFACTURERS ALLIANCE https://www.igmaonline.org/
ICS	INTELLIGENCE COMMUNITY STANDARD https://www.hsdl.org/c/
IAPMO	INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
	http://www.japmo.org
ICPA	INTERNATIONAL CAST POLYMER ASSOCIATION https://theicpa.com/
ICC	INTERNATIONAL CODE COUNCIL https://www.iccsafe.org/
ICRI	INTERNATIONAL CONCRETE REPAIR INSTITUTE https://www.icri.org/

NETA	INTERNATIONAL ELECTRICAL TESTING ASSOCIATION https://www.netaworld.org/
IEC	INTERNATIONAL ELECTROTECHNICAL COMMISSION https://www.iec.ch/
IGSHPA	INTERNATIONAL GROUND SOURCE HEAT PUMP ASSOCIATION https://igshpa.org/
IIAR	INTERNATIONAL INSTITUTE OF AMMONIA REFRIGERATION https://www.ijar.org
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION https://www.iso.org
ISEA	INTERNATIONAL SAFETY FOLIPMENT ASSOCIATION https://safetyequipment.org/
ISA	
	IPC - ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES <u>IIILP://WWW.IPC.Org</u>
	L.H. BAILEY HORIORIOWI <u>https://plantblo.cais.comeil.edu/nortonum/</u>
MISS	MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY
MPI	MASTER PAINTERS INSTITUTE http://www.mpi.net/
мні	MATERIAL HANDLING INDUSTRY OF AMERICA http://www.mbj.org
	MIDDLE ATLANTIC PRODUCTS https://www.logrand.us/middle.atlantic.products
	MIDDLE ATLANTIC PRODUCTS <u>IIIIps://www.iegrand.us/middle-atlantic-products</u>
	MIDWEST INSULATION CONTRACTORS ASSOCIATION <u>https://www.micainsulation.org/</u>
NACE	NACE INTERNATIONAL <u>https://www.nace.org</u>
NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION <u>https://www.nasa.gov/</u>
NADCA	NATIONAL AIR DUCT CLEANERS ASSOCIATION <u>https://nadca.com/</u>
NAAMM	NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS <u>http://www.naamm.org</u>
NECA	NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION https://www.necanet.org/
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION https://www.nema.org
NEBB	NATIONAL ENVIRONMENTAL BALANCING BUREAU http://www.nebb.org
NFRC	NATIONAL FENESTRATION RATING COUNCIL http://www.nfrc.org
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION https://www.nfpa.org
NFLPA	NATIONAL FLUID POWER ASSOCIATION https://www.nfpa.com
NHLA	NATIONAL HARDWOOD LUMBER ASSOCIATION https://nhla.com/
NIOSH	NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH https://www.cdc.gov/piosh/
NII	NATIONAL INSTITUTE OF ILISTICE https://www.justnet.org/
NIST	NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY https://www.pist.gov/
	NATIONAL READY MIXED CONCRETE ASSOCIATION https://www.mst.gov/
1122	
NAVFAC EXWC	NAVAL FACILITIES ENGINEERING AND EXPEDITIONARY WARFARE CENTER
	https://www.navfac.navy.mil/navfac_worldwide/specialty_centers/exwc.html
NAIMA	NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION <u>https://insulationinstitute.org</u>
NELMA	NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION <u>https://www.nelma.org/</u>
NSF	NSF INTERNATIONAL <u>http://www.nsf.org</u>
ONVIF	OPEN NETWORK VIDEO INTERFACE FORUM https://www.onvif.org/
OECD	ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT http://www.oecd.org
PHI	PASSIVE HOUSE INSTITUTE INTERNATIONAL https://passivehouse.com/
PHIUS	PASSIVE HOUSE INSTITUTE - US <u>http://phius.org/home-page</u>
PDCA	PILE DRIVING CONTRACTORS ASSOCIATION http://www.piledrivers.org/
PFI	PIPE FABRICATION INSTITUTE https://pfi-institute.org/
PPFA	PLASTIC PIPE AND FITTINGS ASSOCIATION https://www.ppfahome.org/
PDI	PLUMBING AND DRAINAGE INSTITUTE http://www.pdiopline.org
PMCA	PLUMBING AND MECHANICAL CONTRACTORS ASSOCIATION http://www.pmcaoregon.com/
PFI	PORCELAIN ENAMEL INSTITUTE http://www.porcelainenamel.com
	PRECAST/PRESTRESSED CONCRETE INSTITUTE https://www.porcelancelancel.com
	DDOCDAMME FOR ENDORSEMENT OF FOREST CEDTIFICATION https://www.pofe.org/
CNA	REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFURINIA REDWOOD ASSOCIATION
D .050	nttps://www.wwpa.org/about-wwpa/redwood-inspection-service
RUSU	RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS <u>http://www.boltcouncil.org</u>
RECI	RESILIENT FLOOR COVERING INSTITUTE https://rtci.com/
SAND	SANDIA NATIONAL LABORATORIES <u>https://energy.sandia.gov/</u>
SCS	SCIENTIFIC CERTIFICATION SYSTEMS https://www.scsglobalservices.com/

SMA	SCREEN MANUFACTURERS ASSOCIATION <u>http://smainfo.org</u>
SMACNA	SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
	https://www.smacna.org/
SPRI	SINGLE PLY ROOFING INDUSTRY https://www.spri.org/
SSPC	SOCIETY FOR PROTECTIVE COATINGS http://www.sspc.org
SAE	SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL https://www.sae.org/
SCTE	SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS https://www.scte.org/
SD DOT SSRB	SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROADS
	AND BRIDGES https://dot.sd.gov
SCMA	SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION http://www.cypressinfo.org
SPIB	SOUTHERN PINE INSPECTION BUREAU https://www.spib.org/
SPFA	SPRAY POLYURETHANE FOAM ALLIANCE http://www.sprayfoam.org
SDI/DOOR	STEEL DOOR INSTITUTE https://www.steeldoor.org/
SWI	STEEL WINDOW INSTITUTE https://www.steelwindows.com/
SFI	SUSTAINABLE FOREST INITIATIVE http://www.sfiprogram.org
ТАРРІ	TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY http://www.tappi.org
TIA	TELECOMMUNICATIONS INDUSTRY ASSOCIATION https://www.tiaonline.org/
TMS	THE MASONRY SOCIETY https://masonrysociety.org/
TCIA	TREE CARE INDUSTRY ASSOCIATION https://tcia.org/
TRIDIUM	TRIDIUM INC https://www.tridium.com/
ты	TRUSS PLATE INSTITUTE https://www.trigt.org/
трі	TUREGRASS PRODUCERS INTERNATIONAL http://www.turfgrasssod.org
	ILS ARMY CORDS OF ENGINEERS http://www.publications.usace.army.mil/
	U.S. CODE http://uscode house gov/
	U.S. DEFENSE LOGISTICS ACENCY http://www.dla.mil
	ACRICULTURAL MARKETING SERVICE https://www.amg.ugda.gov/
	AGRICULI URAL MARKETING SERVICE <u>IIILps://www.afris.usud.gov/</u>
USDA	
DUC	U.S. DEPARTMENT OF COMMERCE <u>https://www.commerce.gov/</u>
NTIS DOD	National Technical Information Service <u>https://www.htis.gov/</u>
DOD	U.S. DEPARTMENT OF DEFENSE <u>https://www.ntis.gov/</u>
ASSIST	Acquisition Streamlining and Standardization Information System
DODSSP	Department of Defense Single Stock Point
DAPS	Document Automation and Production Service <u>https://assist.dla.mil/online/start/</u>
UFC	Unified Facilities Criteria <u>https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc</u>
WBDG	Whole Building Design Guide
NIBS	National Institute of Building Sciences
DOE	U.S. DEPARTMENT OF ENERGY <u>https://www.energy.gov/</u>
FEMP	U.S. DEPARTMENT OF ENERGY FEDERAL ENERGY MANAGEMENT PROGRAM
	https://www.energy.gov/eere/femp/federal-energy-management-program
HUD	U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT <u>https://www.huduser.gov</u>
SD	U.S. DEPARTMENT OF STATE <u>https://www.state.gov/</u>
EPA	U.S. ENVIRONMENTAL PROTECTION AGENCY <u>https://www.epa.gov</u>
NTIS	National Technical Information Service https://www.ntis.gov/
GPO	U.S. Government Publishing Office https://www.gpo.gov/
FAA	U.S. FEDERAL AVIATION ADMINISTRATION https://www.faa.gov/
FCC	U.S. FEDERAL COMMUNICATIONS COMMISSION https://www.fcc.gov/
GPO	U.S. Government Publishing Office https://www.gpo.gov/
FHWA	U.S. FEDERAL HIGHWAY ADMINISTRATION https://www.fhwa.dot.gov/
GPO	U.S. Government Publishing Office <u>https://www.gpo.gov/</u>
GSA	U.S. GENERAL SERVICES ADMINISTRATION https://www.gsaelibrary.gsa.gov/ElibMain/home.do
ASSIST	Acquisition Streamlining and Standardization Information System
	https://assist.dla.mil/online/start/
USGBC	U. S. GREEN BUILDING COUNCIL https://new.usgbc.org/
NARA	U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION https://www.archives.gov/
ULE	UL ENVIRONMENT https://industries.ul.com/environment/
UL	UNDERWRITERS LABORATORIES https://www.ul.com/
ULC	UNDERWRITERS LABORATORIES OF CANADA https://canada.ul.com/

UBPPA	UNI-BELL PVC PIPE ASSOCIATION <u>https://www.uni-bell.org/</u>
WCLIB	WEST COAST LUMBER INSPECTION BUREAU http://www.wclib.org
WWPA	WESTERN WOOD PRODUCTS ASSOCIATION http://www.wwpa.org
WDMA	WINDOW AND DOOR MANUFACTURERS ASSOCIATION https://www.wdma.com/
WMMPA	WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION https://www.wmmpa.com/
WI	WOODWORK INSTITUTE https://woodworkinstitute.com
WBI	WOOLMARK COMPANY https://www.woolmark.com/

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01 45 00 QUALITY CONTROL

PART 1 GENERAL

1.1 SUMMARY

Establish and maintain an effective quality control (QC) system. QC consist of plans, procedures, and organization necessary to produce a product which complies with the Contract requirements. The QC system covers all construction operations, both onsite and offsite, and be keyed to the proposed construction sequence.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D3740______Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction ASTM E329______Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-12 Engineering and Design -- Quality Management

1.3 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include all associated costs in the Bid.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Preconstruction Submittals
 - 1. Contractor Quality Control (CQC) Plan
 - 2. Additional Requirements for Design Quality Control (DQC) Plan
- B. Design Data
 - 1. Discipline-Specific Checklists
 - 2. Design Quality Control
- C. Test Reports
 - 1. Verification Statement

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The project superintendent will be held responsible for the quality of work and is subject to removal by the Project Manager for non-compliance with the quality requirements specified in the Contract. In this context the highestlevel manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Project Manager.

3.2 CONTRACTOR QUALITY CONTROL (CQC) PLAN

Submit no later than 15 days after receipt of Notice to Proceed, the Contractor Quality Control (CQC) Plan. The Owner will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

A. Content of the CQC Plan

Include, as a minimum, the following to cover all construction-operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to an individual other than the project superintendent. The individual should be outside of the project superintendent's chain of command and must be shown as at least one level above the project superintendent in the chain of command.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Project Manager.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Project Manager are required to be used.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section.
- j. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections. Where the applicable code issued by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the Quality Control Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the QC Plan.
- B. Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Owner reserves the right to require the Contractor to make changes in the Contractor Quality Control(CQC) Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

C. Notification of Changes After acceptance of the CQC Plan, notify the Project Manager in writing of any proposed change. Proposed changes are subject to acceptance by the Project Manager.

3.3 QUALITY CONTROL ORGANIZATION

A. Personnel Requirements

The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Project Manager.

Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible for maintaining these documents and records at the site at all times, except as otherwise acceptable to the Project Manager.

B. CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC System Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 10 years construction experience on construction similar to this Contract. This CQC System Manager is on the site at all times during construction and is employed by the prime Contractor. The CQC System Manager is assigned as CQC System Manager and may have duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CQC System Manager.

C. CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, structural, architectural, Cx Agent/LEED Specialist. These individuals or specialized technical companies are to be directly employed by the prime Contractor and can not be employed by a supplier or subcontractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on the specialized peronnel's areas of responsibility; have the necessary education or experience in accordance with the experience matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality control duties as described in the Quality Control Plan. A single person can cover more than one area provided that the single person is qualified to perform quality control activities in each designated and that workload allows.

D. Additional Requirement

In addition to the above experience and education requirements, the Contractor Quality Control (CQC) System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Contractors course. If the CQC System Manager does not have a current certification, obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Army Corps of Engineers. The Construction Quality Management Training certificate expires after 5 years. If the CQC System Manager's certificate has expired, retake the course to remain current.

E. Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Project Manager for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, have to comply with the requirements in Section 01 33 00 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 15 TOTAL BUILDING COMMISSIONING are included in the contract, the submittals required by those sections have to be coordinated with Section 01 33 00 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

A. Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Owner personnel until final acceptance of the work.
- b. Review of the Contract drawings.

c. Check to assure that all materials and equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
- f. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. Review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Project Manager.
- j. Discussion of the initial control phase.
- k. The Owner needs to be notified at least 72 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.
- B. Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

- a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing are in compliance with the contract.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Owner needs to be notified at least 72 hours in advance of beginning the initial phase for definable feature of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases.
- g. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
- C. Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

D. Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

A. Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Owner duplicate samples of test specimens for possible testing by the Owner. Testing includes operation and acceptance tests when specified. Procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

- 1. Verify that testing procedures comply with contract requirements.
- 2. Verify that facilities and testing equipment are available and comply with testing standards.
- 3. Check test instrument calibration data against certified standards.
- 4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

- 5. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Project Manager, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Project Manager. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.
- B. Testing Laboratories

All testing laboratories must be validated by the USACE Material Testing Center (MTC) for the tests to be performed. Information on the USACE MTC with web-links to both a list of validated testing laboratories and for the laboratory inspection request for can be found at: <u>https://mtc.erdc.dren.mil/</u>.

1. Capability Check

The Owner reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.

2. Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be responsible for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

C. Onsite Laboratory

The Owner reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Owner.

3.8 COMPLETION INSPECTION

A. Punch-Out Inspection

Conduct an inspection of the work by the CQC System Manager near the end of the work, or any increment of the work established by a time stated in the Contract or as amended per the Contract documents. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Owner that the facility is ready for the Owner Substantial Completion Inspection.

B. Substantial Completion Inspection

The Owner will perform the Substantial Completion Inspection to verify that the facility is complete and ready to be occupied. An Owner Substantial Completion Inspection Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Owner, so that a Final Inspection with the customer can be scheduled. Correct any items noted on the Substantial Completion Inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

C. Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Project Manager is required to be in attendance at the final acceptance inspection. Additional Owner personnel will also be in attendance. The final acceptance inspection will be formally scheduled by the Project Manager based upon results of the Substantial Completion Inspection and Contractor's log for corrective work verifying completion. Notify the Project Manager when all items have been completed and ready for the final acceptance inspection. Include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the Contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Project Manager to bill the Contractor for the Owner's additional inspection cost.

3.9 DOCUMENTATION

A. Quality Control Activities

Maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

- 1. The name and area of responsibility of the Contractor/Subcontractor.
- 2. Operating plant/equipment with hours worked, idle, or down for repair.
- 3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- 4. Test and control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- 5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- 6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
- 7. Offsite surveillance activities, including actions taken.
- 8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- 9. Instructions given/received and conflicts in plans and specifications.
- B. Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Owner daily within 48 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit one report for every 14 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the Contractor Quality Control (CQC) System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Project Manager will notify the Contractor of any detected noncompliance with the foregoing requirements. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Project Manager can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- END OF SECTION 01 45 00--
01 45 29 TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

C.

D.

This section specifies materials testing activities and inspection services required during project construction to be provided by an independent Testing Laboratory arranged for and paid by the Contractor.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):

	T27-11	Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
	T96-02 (R2006)	Standard Method of Test for Resistance to Degradation of Small-Size Coarse
		Aggregate by Abrasion and Impact in the Los Angeles Machine
	Т99-10	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg
		(5.5 lb.) Rammer and a 305 mm (12 in.) Drop
	T104-99 (R2007)	Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate
		or Magnesium Sulfate
	T180-10	Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg
		(10 lb.) Rammer and a 457 mm (18 in.) Drop
	T191-02(R2006)	Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method
	T310-13	Standard Method of Test for In-place Density and Moisture Content of Soil and
		Soil-aggregate by Nuclear Methods (Shallow Depth)
Am	erican Concrete Institute (A	ACI):
	214.4R-10	, Guide for Obtaining Cores and Interpreting Compressive Strength Results
	214R-11	Guide to Evaluation of Strength Test Results of Concrete
	311.5-04	Guide for Concrete Plant Inspection and Testing of Ready-Mixed Concrete
	506.4R-94	Guide for the Evaluation of Shotcrete
Am	erican Society for Testing a	nd Materials (ASTM):
	A325-10	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi
		Minimum Tensile Strength
	A370-12	Standard Test Methods and Definitions for Mechanical Testing of Steel
		Products
	A416/A416M-10	Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed
	,	Concrete
	A490-12	Standard Specification for Heat Treated Steel Structural Bolts, 150 ksi Minimum
		Tensile Strength
	C31/C31M-10	Standard Practice for Making and Curing Concrete Test Specimens in the Field
	C33/C33M-11a	Standard Specification for Concrete Aggregates
	C39/C39M-12	Standard Test Method for Compressive Strength of Cylindrical Concrete
	,	Specimens
	C109/C109M-11b	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
	, C136-06	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
	C138/C138M-10b	Standard Test Method for Density (Unit Weight), Yield, and Air Content
	·	(Gravimetric) of Concrete
	C140-12	Standard Test Methods for Sampling and Testing Concrete Masonry Units and
		Related Units
	C143/C143M-10a	Standard Test Method for Slump of Hydraulic Cement Concrete
	C172/C172M-10	Standard Practice for Sampling Freshly Mixed Concrete
	C173/C173M-10b	Standard Test Method for Air Content of freshly Mixed Concrete by the
		Volumetric Method
	C330/C330M-09	Standard Specification for Lightweight Aggregates for Structural Concrete
	C567/C567M-11	Standard Test Method for Density Structural Lightweight Concrete
	C780-11	Standard Test Method for Pre-construction and Construction Evaluation of
		Mortars for Plain and Reinforced Unit Masonry
	C1019-11	Standard Test Method for Sampling and Testing Grout

	C1064/C1064M-11	Standard Test Method for Temperature of Freshly Mixed Portland Cement
	C1077-11c	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
	C1314-11a	Standard Test Method for Compressive Strength of Masonry Prisms
	D422-63(2007)	Standard Test Method for Particle-Size Analysis of Soils
	D698-07e1	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
	D1140-00(2006)	Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve
	D1143/D1143M-07e1	Standard Test Methods for Deep Foundations Under Static Axial Compressive Load
	D1188-07e1	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
	D1556-07	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand- Cone Method
	D1557-09	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft3 (2,700 KNm/m3))
	D2166-06	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
	D2167-08)	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
	D2216-10	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
	D2974-07a	Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
	D3666-11	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
	D3740-11	Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction
	D6938-10	Standard Test Method for In-Place Density and Water Content of Soil and Soil- Aggregate by Nuclear Methods (Shallow Depth)
	E94-04(2010)	Standard Guide for Radiographic Examination
	E164-08	Standard Practice for Contact Ultrasonic Testing of Weldments
	E329-11c	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
	E543-09	Standard Specification for Agencies Performing Non-Destructive Testing
	E605-93(R2011)	Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members
	E709-08	Standard Guide for Magnetic Particle Examination
	E1155-96(R2008)	Determining FF Floor Flatness and FL Floor Levelness Numbers
E.	American Welding Society	(AWS):

D1.D1.1M-10 Structural Welding Code-Steel

1.3 REQUIREMENTS

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. **Inspection and Testing:** Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by AE. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Project Manager to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to AE, Contractor, unless other arrangements are agreed to in writing by the AE. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to AE immediately of any irregularity.

PART 3 - EXECUTION

- 3.1 EARTHWORK:
 - A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
 - 1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the AE regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to AE extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 - 2. Provide part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 - 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
 - B. Testing Compaction:
 - 1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used.
 - 2. Make field density tests in accordance with the primary testing method wherever possible. Field density tests shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the AE before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 2000 square feet of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 2000 square feet of overlaying building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: One test per 100 feet of each layer of compacted fill but in no case fewer than two tests.
 - c. Pavement Subgrade: One test for each 400 square yards, but in no case fewer than two tests.
 - d. Curb, Gutter, and Sidewalk: One test for each 300 feet, but in no case fewer than two tests.
 - e. Trenches: One test at maximum 100 foot intervals per 4 foot of vertical lift and at changes in required density, but in no case fewer than two tests.
 - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to AE. In each compacted fill layer below wall footings, perform one field density test for every 100 feet of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
 - C. Fill and Backfill Material Gradation: One test per 300 cubic yards stockpiled or in-place source material.
 - D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
 - E. Testing Materials: Test suitability of on-site and off-site borrow as directed by AE.

3.2 FOUNDATION PILES

- A. Witness load test procedure for conformance with ASTM D1143 and interpret test data to verify geotechnical recommendations for pile capacity. Submit load test report in accordance with ASTM D1143.
- B. Review Contractor's equipment, methods, and procedures prior to starting any work on site. Provide continuous inspection of pile installation. Maintain a record of all pertinent phases of operation for submittal to AE.
- C. Auger-Placed Piles: Take and test samples of grout in accordance with ASTM C109 for conformance with specified strength requirements. Not less than six cubes shall be made for each day of casting. Test three cubes at 7 days and three at 28 days.
- D. Cast-in-Place Concrete Piles: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.

- E. Pre-stressed Concrete Piles:
 - 1. Inspection at Plant: Inspect forms, placement of reinforcing steel and strands, placement and finishing of concrete, and tensioning of strands.
 - 2. Concrete Testing: Test concrete including materials for concrete as required in Article, CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
 - 3. Test strand for conformance with ASTM A416/A416M and furnish report to AE.
 - 4. Inspect piles to insure specification requirements for curing and finishes have been met.

3.3 FOUNDATION CAISSONS

- A. Concrete Testing: Test concrete including materials for concrete as required in Article, CONCRETE of this section, except make two test cylinders for each day's placement of concrete.
- B. Maintain a record of concrete used in each caisson. Compare records with calculated volumes.
- C. Inspect percussion hole in bottom of each caisson to determine that material is capable of supporting design load.
- D. Inspect sides and bottom of each caisson for compliance with contract documents.
- E. Submit a certified "Caisson Field Record" for each caisson, recording actual elevation at bottom of shaft; final center line location of top; variation of shaft from plumb; results of all tests performed; actual allowable bearing capacity of bottom; depth of socket into rock; levelness of bottom; seepage of water; still water level (if allowed to flood); variation of shaft (from dimensions shown); location and size of reinforcement, and evidence of seams, voids, or channels below the bottom. Verify the actual bearing capacity of the rock strata by the use of a calibrated penetrometer or other acceptable method.
- F. Caissons Bearing on Hardpan: Take undisturbed samples, suitable for tests required, from caisson bottom. Make auger probe to a depth of 8 feet below bottom and visually inspect and classify soil. Verify continuity of strata and thickness.
 - 1. Conduct the following test on each sample, and report results and evaluations to the AE:
 - a. Unconfined Compression Test (ASTM D2166).
 - b. Moisture Content (ASTM D2216).
 - c. Density.

3.4 LANDSCAPING

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
 - 1. Test for organic material by using ASTM D2974.
 - 2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
- B. Submit laboratory test report of topsoil to AE.

3.5 ASPHALT CONCRETE PAVING

- A. Aggregate Base Course:
 - 1. Determine maximum density and optimum moisture content for aggregate base material in accordance with // AASHTO T180, Method D // ASTM D1557, Method D //
 - 2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with // AASHTO T191 // ASTM D1556 //.
 - 3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.
- B. Asphalt Concrete:
 - Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
 - 2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
 - 3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.6 SITE WORK CONCRETE

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.7 POST-TENSIONING OF CONCRETE

A. Inspection Prior to Concreting: Inspect tendons, drape of tendons, and anchorage components for compliance prior to concreting.

- B. Concrete Testing: As required in Article, CONCRETE of this section except make three test cylinders representing each area to be tensioned and cylinders shall be cured in same manner as concrete they represent. Make compression test prior to determining minimum specified strength required for post-tensioning.
- C. Post-tensioning: Witness post-tensioning operation and record actual gauge pressures and elongations applied to each tendon.
- D. Submit reports in quadruplicate of the following:
 - 1. Inspection of placement and post-tensioning of all tendons.
 - 2. Size, number, location, and drape of tendons.
 - 3. Calculated elongations, based upon the length, modulus of elasticity, and cross-sectional area of the tendons used.
 - 4. Actual field elongations. Check elongation of tendons within ranges established by manufacturer.
 - 5. Calculated gauge pressure and jacking force applied to each tendon.
 - 6. Actual gauge pressures and jacking force applied to each tendon.
 - 7. Required concrete strength at time of jacking.
 - 8. Actual concrete strength at time of jacking.
 - 9. Do not cut or cover the tendon ends until the Contractor receives the AE's written approval of the posttensioning records.

3.8 CONCRETE

- A. Batch Plant Inspection and Materials Testing:
 - 1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of AE with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by AE.
 - 2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to AE.
 - 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
 - 4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
 - 5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.
- B. Field Inspection and Materials Testing:
 - 1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
 - 2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
 - 3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 50 cubic yards or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. AE may require additional cylinders to be molded and cured under job conditions.
 - 4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
 - 5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 25 cubic yards thereafter each day. For concrete not required to be air-entrained, test every 100 cubic yards at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
 - 6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
 - 7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
 - 8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
 - 9. Verify that specified mixing has been accomplished.

- 10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 40 degrees F, record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 85 degrees F, record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
- 11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
- 12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
- 13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
- 14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
- 15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
- 16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
- 17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
- 18. Measure concrete flatwork for levelness and flatness as follows:
 - a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the AE with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
- 19. Other inspections:
 - a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
 - Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by AE. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
 - 2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
 - 3. Furnish certified compression test reports (duplicate) to AE. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m³ (pounds per cubic feet).
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.
 - j. Date delivered to laboratory and date tested.

3.9 REINFORCEMENT

- A. Review mill test reports furnished by Contractor.
- B. Perform sampling at fabricating plant. Take two samples from each 25 tons or fraction thereof of each size of reinforcing steel No. 3 thru No. 18.
- C. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- D. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- E. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.10 SHOTCRETE

- A. Inspection and Material Testing:
 - 1. Provide field inspection and testing service as required by AE to certify that shotcrete has been applied in accordance with contract documents.
 - 2. Periodically inspect and test proportioning equipment for accuracy and report deficiencies to AE.
 - 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
 - 4. Sample and test aggregates daily and as necessary for moisture content. Report instances of excessive moisture to AE.
 - 5. Certify, in duplicate, that ingredients and proportions and amounts of ingredients in shotcrete conform to approved trial mixes.
 - 6. Provide field inspection of the proper size and placement of the reinforcement in the shotcrete.
- B. Shotcrete Sampling:
 - 1. Provide a technician at site of placement to perform shotcrete sampling.
 - 2. Take cores in accordance with ACI 506.
 - 3. Insure maintenance of water-cement ratio established by approved trial mix.
 - 4. Verify specified mixing has been accomplished.
- C. Laboratory Tests of Field Sample Panels:
 - 1. Compression test core for strength in accordance with ACI 506. For each test series of three cores, test one core at 7 days and one core at 28 days. Use remaining core as a spare to be tested at either 7 or 28 days as required. Compile laboratory test reports as follows: Compressive strength test shall be result of one core, except when one core shows evidence of improper sampling or testing, in which case it shall be discarded and strength of spare core shall be used.
 - 2. Submit certified compression test reports (duplicate) to AE. On test report, indicate following information:
 - a. Core identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Compressive strength of shotcrete in psi.
 - d. Weather conditions during placing.
 - e. Temperature of shotcrete in each test core when test core was taken.
 - f. Maximum and minimum ambient temperature during placing.
 - g. Ambient temperature when shotcrete sample was taken.
 - h. Date delivered to laboratory and date tested.
- D. Submit inspection reports certification and instances of noncompliance to AE.

3.11 PRESTRESSED CONCRETE:

- A. Inspection at Plant: Forms, placement and concrete cover of reinforcing steel and tendons, placement and finishing of concrete, and tensioning of tendons.
- B. Concrete Testing: Test concrete including materials for concrete required in Article, CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
- C. Test tendons for conformance with ASTM A416 and furnish report to AE.
- D. Inspect members to insure that specification requirements for curing and finishes have been met.
- 3.12 ARCHITECTURAL PRECAST CONCRETE:
 - A. Inspection at Plant: Forms, placement of reinforcing steel, concrete cover, and placement and finishing of concrete.
 - B. Concrete Testing: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
 - C. Inspect members to insure specification requirements for curing and finishes have been met.

3.13 MASONRY:

- A. Mortar Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.
 - b. Obtain samples during or immediately after discharge from batch mixer.
 - c. Furnish molds with 2 inch, 3 compartment gang cube.
 - d. Test one sample at 7 days and 2 samples at 28 days.
 - 2. Two tests during first week of operation; one test per week after initial test until masonry completion.
- B. Grout Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 2500 square feet of masonry.
- C. Masonry Unit Tests:
 - 1. Laboratory Compressive Strength Test:
 - a. Comply with ASTM C140.
 - b. Test 3 samples for each 5000 square feet of wall area.
- D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 5000 square feet of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
- 3.14 STRUCTURAL STEEL:
 - A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
 - B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
 - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
 - 3. Approve welder qualifications by certification or retesting.
 - 4. Approve procedure for control of distortion and shrinkage stresses.
 - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
 - C. Fabrication and Erection:
 - 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
 - i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
 - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
 - 2. Bolt Inspection:
 - a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.

- Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
- c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
- d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
- e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
- f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to AE.

3.15 STEEL DECKING:

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to AE.

3.16 SHEAR CONNECTOR STUDS:

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to AE.

3.17 SPRAYED-ON FIREPROOFING:

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from AE.
- C. Use approved installation in test areas as criteria for inspection of work.
- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- E. Location of test areas for field tests as follows:
 - 1. Thickness: Select one bay per floor, or one bay for each 10,000 square feet of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
 - 2. Density: Take density determinations from each floor, or one test from each 10,000 square feet of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.
- F. Submit inspection reports, certification, and instances of noncompliance to AE.

3.18 TYPE OF TEST:

Approximate Number of Tests Required

- A. Earthwork: Laboratory Compaction Test, Soils: //(AASHTO T180)//(AASHTO T99)//(ASTM D1557)//(ASTM D698)// Field Density, Soils (AASHTO T191, T205, or T310) Penetration Test, Soils
 - B. Landscaping: Topsoil Test

C.	Aggregate Base: Laboratory Compaction, // (AASHTO T180)// //(ASTM D1557)// Field Density,//(AASHTO T191)// //(ASTM D1556)// Aggregate, Base Course Gradation (AASHTO T27)	
D.	Asphalt Concrete: Field Density, (AASHTO T230)//ASTM D1188// Aggregate, Asphalt Concrete Gradation (AASHTO T27)	
E.	Concrete: Making and Curing Concrete Test Cylinders (ASTM C31) Compressive Strength, Test Cylinders (ASTM C39) Concrete Slump Test (ASTM C143) Concrete Air Content Test (ASTM C173) Aggregate, Normal Weight: Gradation (ASTM C33) Aggregate, Lightweight Gradation (ASTM C330)	
F.	Reinforcing Steel: Tensile Test (ASTM A370) Bend Test (ASTM A370) Mechanical Splice (ASTM A370) Welded Splice Test (ASTM A370)	
G.	Shotcrete: Taking and Curing Test Cores (ACI 506) Compressive Strength, Test Cores (ACI 506)	
н.	Prestressed Concrete: Testing Strands (ASTM A416)	
I.	Masonry: Making and Curing Test Cubes (ASTM C109) Compressive Strength, Test Cubes (ASTM C109) Sampling and Testing Mortar, Comp. Strength (ASTM C780) Sampling and Testing Grout, Comp. Strength (ASTM C1019) Masonry Unit, Compressive Strength (ASTM C140) Prism Tests (ASTM C1314)	
J.	Structural Steel: Ultrasonic Testing of Welds (ASTM E164) Magnetic Particle Testing of Welds (ASTM E709) Radiographic Testing of Welds (ASTM E94)	
К.	Sprayed-On Fireproofing: Thickness and Density Tests (ASTM E605)	
L.	Inspection: Technical Personnel (Man-days)	
L.	 Technical Personnel: Technicians to perform tests and inspection listed above. Laboratory cylinder storage facilities, compression machine, cube molds, procto ovens, slump cones, air meter, and all necessary equipment for complexity of the storage facilities. 	(Minimum months) will be equipped with concrete r molds, balances, scales, moisture paction control.

END 01 45 29

01 50 00 TEMPORARY FACILITIES

PART 1 – GENERAL

1.1 SUMMARY

This section includes requirements for temporary job trailer, restroom facilities, storage, enclosures, and other temporary items for the duration of the project.

1.2 TEMPORARY OFFICE/JOB TRAILER

The Contractor may, at their option, erect or bring on the site when directed, maintain in good condition, and remove when directed, a temporary, weathertight office, for his use and representatives of the AE and/or the Dept. of the Military. It shall be adequately heated and electrically lighted. The Contractor shall maintain a listed telephone at the temporary office. All costs related to the office, including but not limited to utilities, utility hookups and disconnects, maintenance, transporting, etc., shall be paid by the Contractor. Such office shall meet with the approval of the AE and the Dept. of the Military.

1.3 RESTROOM FACILITIES

- 1. The Contractor shall provide and maintain sanitary, temporary chemical toilet(s) located where indicated by the AE.
- 2. The temporary toilets shall be enclosed, weatherproofed, protected and secured from movement or overturning, and kept in a sanitary condition at all times.
- 3. The temporary toilets shall be supplied with the following requirements:
 - a. Constructed of fiberglass or (polyethylene) material.
 - b. Equipped with 40 gallon capacity holding tank.
 - c. Unit shall have separate urinal, be properly vented, locking door.
 - d. Provide number of units and maintenance according to the following:

Number of People	Minimum Number of Facilities at Job Site	Maintenance Period
20 or less	One	Two Weeks
20 - 199	One unit per 40 people at site	One Week
200 more	One unit per 50 people at site	One Week

- e. Maintenance shall include pump holding tank, wash and deodorize entire unit (weather permitting), equipped with four (4) rolls of toilet paper, repair any damages.
- f. The construction of a cesspool or a pit privy is prohibited.

1.4 STORAGE BUILDINGS

The Contractor and/or Sub-contractors may construct or bring on the site, such storage buildings as necessary to protect materials, tools or equipment for use on the project. Such buildings shall meet with the approval of the AE and shall be removed from the site upon completion of the work of the respective Contractor. The location of the storage buildings shall be as approved by the AE.

1.5 TEMPORARY ENCLOSURES

- A. The Contractor shall provide and install temporary weathertight enclosures for all exterior openings to protect work from weather. Equip exterior doors with self-closing hardware and padlocks.
- B. Provide and install temporary sash frames or enclosures for all exterior window openings. Fasten securely in place but capable of removal when required.

PART 2 – PRODUCTS

2.1 BARRICADES

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.2 TEMPORARY SIGNAGE

A. Bulletin Board

Within one calendar day of mobilization on site and prior to the commencement of work activities, provide a

clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, Safety and Health Information and other information.

B. Project Identification Signs

The requirements for the signs, their content, and location are as indicated and as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs 2 days prior to the Ground Breaking Ceremony or 15 days after receipt of the Notice to Proceed, whichever is earliest. The Project Manager will provide as much notice as possible when a Ground Breaking Ceremony is scheduled.

C. Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site.

2.3 BARRICADES

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.4 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. Specific fencing requirements are as described herein.

A. Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of 2 inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

B. Chain Link Panel Fencing

Temporary panel fencing must be galvanized steel chain link panels 6 feet high. Multiple fencing panels may be linked together at the bases to form long spans as needed. Each panel base must be weighted down using sand bags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

2.5 TEMPORARY WIRING

Provide temporary wiring in accordance with NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

PART 3 - EXECUTION

3.1 EMPLOYEE PARKING

Construction contract employees will park privately owned vehicles in an area designated by the Owner. This area will be within reasonable walking distance of the construction site. Employee parking must not interfere with existing and established parking requirements of the installation.

3.2 TEMPORARY BULLETIN BOARD

Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees.

3.3 TEMPORARY UTILITIES

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.4 CONTRACTOR'S TEMPORARY OFFICE/JOB TRAILER

Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Owner. A sign not smaller than 24 by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number.

Trailers must be anchored to resist high winds and must meet applicable state of local standards for anchoring mobile trailers.

- A. Appearance of Trailers and Buildings
 - 1. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements.
 - 2. Must present a clean and neat exterior appearance, with paint or graphic wrapping.
 - 3. In good condition, free from visible damage, rust, deterioration, and meet all applicable safety requirements and be in a state of good repair.
 - 4. Trailers or buildings rusted, have peeling paint or graphics, or are otherwise in need of repair will not be allowed on Installation property.
 - 5. Failure to meet appearance requirements or properly maintain to the appearance standards will result in formal notification from the Owner to the Contractor.
 - a. The Owner will provide formal notice to the Contractor to remove the non-complying units at the Contractor's expense.
 - b. Failure to remove the identified trailer or building will result in the Contractor being assessed \$250.00 per calendar day beginning the next calendar day from the deadline date indicated on the formal notice from the Owner until the unit is removed from the property.
 - c. Assessed Public Perception Fees will be deducted from the Contractor's Contract utilizing the Construction Change Order process.

3.5 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary in accordance with the technical specifications.

END 01 50 00

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SECTION 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS

PART 1-GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
 - 1. Adversely effect human health or welfare,
 - 2. Unfavorably alter ecological balances of importance to human life,
 - 3. Effect other species of importance to humankind, or;
 - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
 - 1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 - 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 - 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 - 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 - 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 - 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
 - 7. Sanitary Wastes:
 - a. Sewage: Domestic sanitary sewage and human and animal waste.
 - b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA): 33 CFR 328
- C. South Dakota Department of Agriculture and Natural Resources
 - 1. Air Quality
 - 2. Watershed Protection Resources
- D. SD DOT Standard Specification for Roads and Bridges, Current Edition
 - 1. Section 734 Erosion Control and Water Pollution Control and Current Supplements
 - 2. Section 831 Geotextile and Impermeable Plastic Membrane
 - 3. Section 891 Dust Control Chlorides
 - 4. Supplemental Specifications to the current edition of the South Dakota Department of Transportation, Standard Specifications for Roads and Bridges.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Follow the manufacturer's recommendation for shipping, handling, and unloading
- B. Follow the manufacturer's recommendation for storage and protection

1.5 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. SD DANR Notice of Intent (NOI)
 - a. Contractor shall complete, submit, and pay all associated fees for the Notice of Intent.

- b. https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/docs/DANR_TemporaryDischargeNOI2018Fi llable.pdf
- 2. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the AE to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 10 days after the meeting, the Contractor shall prepare and submit to the AE for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed.
 - f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan.
 - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. Materials shall comply with the requirements of SD DOT Standard Specifications for Roads and Bridges, Current Edition and Current Supplemental.

PART 3 - EXECUTION

3.1 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the AE. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
 - Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
 - 2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.

- 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
- 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 - a. Sediment Basins: Trap sediment from construction areas in temporary sediment. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
 - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
- 5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
- 6. Manage and control spoil areas to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
- 7. Protect adjacent areas from despoilment by temporary excavations and embankments.
- 8. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Containers shall be equipped with lids to prevent waste from blowing out of the container and off site. Transport all solid waste off site and dispose of waste in compliance with Federal, State, and local requirements.
- 9. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
- 10. Handle discarded materials other than those included in the solid waste category as directed by the AE.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
 - 1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 - 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
 - 3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
 - 1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
 - 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
 - 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 - 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the AE. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
 - 1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 7:00 p.m unless otherwise permitted by local ordinance or the AE. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

a.	Maintain maximum permissible construction equipment noise levels at 50 feet (dBA)

EARTHMOVING		MATERIALS HANDLING		
FRONT LOADERS	75	CONCRETE MIXERS	75	
BACKHOES	75	CONCRETE PUMPS	75	
DOZERS	75	CRANES	75	
TRACTORS	75	DERRICKS IMPACT	75	
SCAPERS	80	PILE DRIVERS	95	
GRADERS	75	JACK HAMMERS	75	
TRUCKS	75	ROCK DRILLS	80	
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80	
PUMPS	75	BLASTING	Not Permitted	
GENERATORS	75	SAWS	75	
COMPRESSORS	75	VIBRATORS	75	

- b. Use shields or other physical barriers to restrict noise transmission.
- c. Provide soundproof housings or enclosures for noise-producing machinery.
- d. Use efficient silencers on equipment air intakes.
- e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
- f. Line hoppers and storage bins with sound deadening material.
- g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
- 3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the <u>A</u> weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at three to six feet in front of any building face. Submit the recorded information to the AE noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the State. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Maintenance: Maintain all erosion and sediment control facilities to provide proper function throughout the Project and for a period of one (1) year from the date of Substantial Completion for the earthwork portion of the project.
- I. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the AE. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

END OF SECTION 01 57 19

01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 273	Standards for	Universal	Waste	Management

- 49 CFR 173 Shippers General Requirements for Shipments and Packaging's
- 49 CFR 178 Specifications for Packaging's

1.2 DEFINITIONS

A. Co-mingle

The practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed.

B. Construction Waste

Waste generated by construction activities, such as scrap materials, damaged or spoiled materials, temporary and expendable construction materials, and other waste generated by the workforce during construction activities.

C. Demolition Debris/Waste

Waste generated from demolition activities, including minor incidental demolition waste materials generated as a result of Intentional dismantling of all or portions of a building, to include clearing of building contents that have been destroyed or damaged.

D. Disposal

Depositing waste in a solid waste disposal facility, usually a managed landfill or incinerator, regulated in the US under the Resource Conservation and Recovery Act (RCRA).

E. Diversion

The practice of diverting waste from disposal in a landfill or incinerator, by means of eliminating or minimizing waste, or reuse of materials.

F. Final Construction Waste Diversion Report

A written assertion by a material recovery facility operator identifying constituent materials diverted from disposal, usually including summary tabulations of materials, weight in short-ton.

G. Recycling

The series of activities, including collection, separation, and processing, by which products or other materials are diverted from the solid waste stream for use in the form of raw materials in the manufacture of new products sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials, other than fuel.

H. Reuse

The use of a product or materials again for the same purpose, in its original form or with little enhancement or change.

I. Salvage

Usable, salable items derived from buildings undergoing demolition or deconstruction, parts from vehicles, machinery, other equipment, or other components.

J. Source Separation

The practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity.

1.3 CONSTRUCTION WASTE (INCLUDES DEMOLITION DEBRIS/WASTE)

Divert a minimum of 60 percent by weight of the project construction waste and demolition debris/waste from the landfill or incinerator. Follow applicable industry standards in the management of waste. Apply sound environmental principles in the management of waste.

- A. Practice efficient waste management when sizing, cutting, and installing products and materials
- B. use all reasonable means to divert construction waste and demolition debris/waste from landfills and incinerators and to facilitate the recycling or reuse of excess construction materials.

1.4 CONSTRUCTION WASTE MANAGEMENT

Implement a Construction Waste Management Program for the project. Take a pro-active, responsible role in the management of construction waste, recycling process, disposal of demolition debris/waste, and require all subcontractors, vendors, and suppliers to participate in the Construction Waste Management Program. Establish a process for clear tracking, and documentation of construction waste and demolition debris/waste.

A. Implementation of Construction Waste Management Program

Develop and document how the Construction Waste Management Program will be implemented in a Construction Waste Management Plan. Submit a Construction Waste Management Plan to the Contracting Officer for approval. Construction waste and demolition debris/waste materials include un-used construction materials not incorporated in the final work, as well as demolition debris/waste materials from demolition activities or deconstruction activities. In the management of waste, consider the availability of viable markets, the condition of materials, the ability to provide material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates.

B. Oversight

The Quality Control Manager, as specified in Section 01 45 00.00 10 QUALITY CONTROL, is responsible for overseeing and documenting results from executing the Construction Waste Management Plan for the project. The Environmental Manager, as specified in Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, is responsible for overseeing and documenting results from executing the Construction Waste Management Plan for the project.

C. Special Programs

Implement special programs involving rebates or similar incentives related to recycling of construction waste and demolition debris/waste materials. Retain revenue or savings from salvaged or recycling, unless otherwise directed. Ensure firms and facilities used for recycling, reuse, and disposal are permitted for the intended use to the extent required by federal, state, and local regulations.

D. Special Instructions

Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the projects. Designation of single source separating or commingling will be clearly marked on the containers.

E. Waste Streams

Delineate waste streams and characterization, including estimated material types and quantities of waste, in the Construction Waste Management Plan. Manage all waste streams associated with the project. Typical waste streams are listed below. Include additional waste steams not listed:

- 1. Land Clearing Debris
- 2. Asphalt
- 3. Masonry and CMU
- 4. Concrete
- 5. Metals (Includes, but is not limited to, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, bronze.)
- 6. Wood (nails and staples allowed)
- 7. Glass
- 8. Paper
- 9. Plastics (PET, HDPE, PVC, LDPE, PP, PS, Other)
- 10. Gypsum
- 11. Non-hazardous paint and paint cans
- 12. Carpet
- 13. Ceiling Tiles
- 14. Insulation
- 15. Beverage Containers

1.5 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Preconstruction Submittals
 - 1. Construction Waste Management Plan
- B. Test Reports
 - 1. Quarterly Reports
 - 2. Annual Report

- C. Closeout Submittals
 - 1. Final Construction Waste Diversion Report

1.6 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Construction Waste Management Plan and to develop a mutual understanding relative to the management of the Construction Waste Management Program and how waste diversion requirements will be met.

The requirements of this meeting may be fulfilled during the coordination and mutual Understanding meeting outlined in Section 01 45 00 – QUALITY CONTROL. At a minimum, discuss and document waste management goals at following meetings:

- A. Preconstruction meeting.
- B. Regular site meetings.
- C. Work safety meeting (if applicable).

1.7 CONSTRUCTION WASTE MANAGEMENT PLAN

Submit Construction Waste Management Plan within 15 calendar days after Notice to Proceed. Revise and resubmit Construction Waste Management Plan as necessary, in order for construction to begin. Execute demolition or deconstruction activities in accordance with Section 02 41 00 – DEMOLITION. Manage demolition debris/waste or deconstruction materials in accordance with the approved construction waste management plan.

An approved Construction Waste Management Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Ensure all subcontractors receive a copy of the approved Construction Waste Management Plan. The plan demonstrates how to meet the project waste diversion requirement. Also, include the following in the plan:

- A. Identify the names of individuals responsible for waste management and waste management tracking, along with roles and responsibilities on the project.
- B. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- C. Description of the regular meetings to be held to address waste management.
- D. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of materials.
- E. Name of landfill and incinerator to be used.
- F. Identification of local and regional re-use programs, including non-profit organizations such as schools, local housing agencies, and organization that accept used materials such as material exchange networks and resale stores. Include the name, location, phone number for each re-use facility identified, and provide a copy of the permit or license for each facility.
- G. List of specific materials, by type and quantity, that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, address, and phone number.
- H. Identification of materials that cannot be recycled or reused with an explanation or justification, to be approved by the Contracting Officer.
- I. Description of the means by which materials identified in item above will be protected from contamination.
- J. Description of the means of transportation of the recyclable materials (whether materials will be siteseparated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- K. Copy of training plan for subcontractors and other services to prevent contamination by co-mingling materials identified for diversion and waste materials.
- L. Identification of at least 5 construction or demolition material streams for diversion.
- M. Detailed plan and distribution of waste diversion between buildings, when project is a part of a campus.
- N. Facilities or subcontractors offering construction waste transport on-site or off-site must ensure that proper shipping orders, bill of lading, manifests, or other shipping documents containing waste diversion information meet requirements of 40 CFR 273 Universal Waste Management, 49 CFR 173 Shippers - General Requirements for Shipments and Packaging's, and 49 CFR 178 Specifications for Packaging. Individuals signing manifests or other shipping documents should meet the minimum training requirements.

- O. List each supplier who deliver construction materials, in bulk, or package products in returnable containers or returnable packaging, or have take-back programs. List each program and the applicable material to actively monitor and track to assist in meeting waste diversion requirements on the project.
- P. Identify local jurisdiction requirements for waste management. Include local requirements and points of contact.

Distribute copies of the waste management plan to each subcontractor, Quality Control Manager Environmental Manager, and the Contracting Officer.

1.8 RECORDS (DOCUMENTATION)

A. General

Maintain records to document the types and quantities of waste generated and diverted though re-use, recycling and sale to third parties; through disposal to a landfill or incinerator facility. Provide explanations for materials not recycled, reused or sold. Collect and retain manifests, weight tickets, sales receipts, and invoices specifically identifying diverted project waste materials or disposed materials.

B. Accumulated

Maintain a running record of materials generated and diverted from landfill disposal, including accumulated diversion rates for the project. Make records available to the Contracting Officer during construction or incidental demolition activities. Provide a copy of the diversion records to the Contracting Officer upon completion of the construction, incidental demolitions or minor deconstruction activities.

1.9 REPORTS

A. General

Maintain current construction waste diversion information on site for periodic inspection by the Contracting Officer. Include in the quarterly reports, annual reports and final reports: the project name, contract information, information for waste generated, diverted and disposed of for the current reporting period and show cumulative totals for the project. Reports must identify quantifies of waste by type and disposal method. Also include in each report, supporting documentation to include manifests, weigh tickets, receipts, and invoices specifically identifying the project and waste material type and weighted sum.

B. Quarterly Reporting

Provide cumulative reports at the end of each quarter (December, March, June, and September, corresponding with the federal fiscal year for reporting purposes). Submit quarterly reports not later than 15 calendar days after the preceding quarter has ended. Submit Quarterly Reports to the Project Manager.

C. Final Reporting

Provide a cumulative construction waste diversion report. Submit report not later than 10 calendar days after the Substantial Completion Inspection. The Final Inspection will not take place until the final report is submitted. The Contractor is responsible for ensuring the report is submitted on time, failure to submit will delay the Final Inspection and potentially subject the Contractor to liquidated damages for failure to have the project ready for Final Inspection. Provide construction waste diversion report to the Project Manager.

1.10 COLLECTION

Collect, store, protect, and handle reusable and recyclable materials at the site in a manner which prevents contamination, and provides protection from the elements to preserve their usefulness and monetary value. Provide receptacles and storage areas designated specifically for recyclable and reusable materials and label them clearly and appropriately to prevent contamination from other waste materials. Keep receptacles or storage areas neat and clean.

Train subcontractors and other service providers to either separate waste streams or use the co-mingling method as described in the Construction Waste Management Plan. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS and Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Separate materials by one of the following methods described herein:

A. Source Separation Method

Separate waste products and materials that are recyclable from trash and sort as described below into appropriately marked separate containers and then transport to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the category types as defined in the Construction Waste Management Plan.

B. Co-Mingled Method

Place waste products and recyclable materials into a single container and then transport to an authorized recycling facility, which meets all applicable requirements to accept and dispose of recyclable materials in accordance with all applicable local, state and federal regulations. The Co-mingled materials must be sorted and processed in accordance with the approved Construction Waste Management Plan.

C. Other Methods Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.11 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures as described in the waste management plan. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the following:

A. Reuse

Give first consideration to reusing construction and demolition materials as a disposition strategy. Recover for reuse materials, products, and components as described in the approved Construction Waste Management Plan. Coordinate with the Contracting Officer to identify onsite reuse opportunities or material sales or donation available through Government resale or donation programs. Sale of recovered materials is allowed on the Installation. Consider the use of surplus industrial supply broker services, who match entities with reusable or repurpose industrial materials with entities with need of such materials.

B. Recycle

Recycle non-hazardous construction and demolition/debris materials that are not suitable for reuse. Track rejection of contaminated recyclable materials by the recycling facility. Rejected recyclables materials will not be counted as a percentage of diversion calculation. Recycle all fluorescent lamps, HID lamps, mercury (Hg) - containing thermostats and ampoules, and PCBs-containing ballasts and electrical components as directed by the Contracting Officer. Do not crush lamps on site as this creates a hazardous waste stream with additional handling requirements.

C. Compost

Consider composting on site if a reasonable amount of compostable materials will be available and a utilization of compostable material can be determined and appropriately planned for. Compostable materials include plant materials, sawdust and certain food scraps. Composting as a strategy must be explicitly addressed in the Construction Waste Management Plan submitted for approval to ensure it is feasible.

D. Waste

Dispose by landfill or incineration only those waste materials with no practical use, economic benefit, or recycling opportunity.

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION - NOT USED.

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01 74 20 WASTE AND RECYCLING TRACKING FORM

Project Name: _____ Project Manager: _____

Contractor:

Project Manager:

Date	Material Description	Weight (lbs.)	Est. Weight if No Ticket	Facility Hauled To:	Recycled Reused	Landfill
27-Dec-22	Salvaged Metals	900	Estimated	Pacific Steel	Х	
1-Jan-23	Scrap Timber & Assorted Construction Debris	2860	Ticket Attached	Rapid City		X
	Total Weight:	0				

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01 76 00 PROTECTING INSTALLED CONSTRUCTION

PART 1 – GENERAL

1.1 SUMMARY

A. Protecting installed construction includes installing, delineating, or other means of ensuring that existing structures, objects, or surfaces remain in their current conditions.

1.2 MEASUREMENT AND PAYMENT

A. Measurement and payment shall be considered incidental to the project. No compensation will be made for materials, equipment, labor, or other resources necessary for Protecting Installed Construction.

1.3 PROTECTION

- A. Existing facilities: protect adjacent walkways, roadways, loading docks, building entries, and other building facilities during demolition operations.
- B. Existing landscaping: protect trees, bushes, plantings, etc. from construction activities. Damage to existing landscaping due to the contractor's negligence to properly protect existing landscaping will result in the contractor replacing or repairing damaged landscaping at the Contractor's cost.
- C. Existing items to remain: protect facilities or infrastructure to remain, against damage and soiling during demolition.
- D. Existing utilities: maintain utility services to all adjacent facilities and protect them against damage during demolition operations.

Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by owner and authorities having jurisdiction.

Provide temporary services during interruptions to existing utilities, as acceptable to owner and to authorities having jurisdiction.

- E. Provide at least 72 hours' notice to owner if shutdown of service is required during changeover.
- F. Temporary protection: erect temporary protection such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
 - a. Protect existing site improvements, appurtenances, and landscaping to remain.
 - b. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - c. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - d. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
- G. Damage to existing structures, objects, or surfaces as a direct result of the contractor's negligence shall be replaced or repaired by the contractor to original or improved conditions. All costs associated with such replacement or repairs shall be paid by the contractor.
- H. Contractor shall take caution to not damage existing roadways or entrances with heavy construction equipment. Contractor shall repair damage caused due to heavy construction traffic.
 - 1. Contractor is to provide visual evidence of before and after conditions.

PART 2 – PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF 01 76 00

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01 78 00 CLOSEOUT SUBMITTALS

PART 1 – GENERAL

1.1 SUMMARY

This section outlines required documentation to be provided to the AE and Owner at the conclusion of the project. Final payment will not be made to the Contractor prior to receipt of all closeout forms.

1.2 REQUIRED SUBMITTALS

- A. Training Plan
- B. Construction Waste & Recycled Materials Forms
- C. Hazardous Material Disposal Forms
- D. Certification of EPA Designated Items
- E. Certification of USDA Designated Items
- F. Recycled Material Weight Tickets
- G. Waste Weight Tickets
- H. Record Drawings
- I. O&M Manuals
- J. Real Property Data Form 1354 (Final)
- K. BUILDER Data Information
- L. Pre-Substantial Completion Punch List
- M. Commissioning Issues Log
- N. Formal Notice of Substantial Completion
- O. Certificate of Substantial Completion
- P. Punch List Verification
- Q. Formal Notice of Final Project Completion
- R. Unemployment Contribution Certificate
- S. Final Application for Payment

PART 2 – PRODUCTS

- 2.1 TRAINING PLAN
 - A. Contractor shall submit their training plan in accordance with section 01 78 23 Operation & Maintenance Data within this project manual.
 - B. Contractor shall submit their written training plan a minimum of 30 calendar days prior to scheduling training.
 - C. All training must be completed prior to the Substantial Completion Inspection.
- 2.2 CONSTRUCTION WASTE & RECYCLED MATERIALS FORMS
 - A. Refer to section 01 74 19 Construction Waste Management for requirements.
 - B. All weight tickets shall be provided to the Owner with the notice of substantially complete or prior.
- 2.3 HAZARDOUS MATERIAL DISPOSAL FORMS
 - A. Refer to section 01 74 19 Construction Waste Management for requirements.
 - B. All weight tickets shall be provided to the Owner with the notice of substantially complete or prior.

2.4 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by the Estimate of Percentage of Recovered Material Content for EPA Designated Items and Affirmative Procurement of EPA designated items in Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

- A. The product does not meet appropriate performance standards;
- B. The product is not available within a reasonable time frame;
- C. The product is not available competitively (from two or more sources);

D. The product is only available at an unreasonable price (compared with a comparable non-recycled content product)."

Record each product used in the project that has a requirement or option of containing recycled content in accordance with SECTION 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, exemptions (a, b, c, or d, as indicated), and comments. Recycled content values may be determined by weight or volume percent but must be consistent throughout.

2.5 CERTIFICATION OF USDA DESIGNATED ITEMS

Submit the Certification of USDA Designated Items as required by the Bio-based Product Certifications and Affirmative Procurement of Biobased Products Under Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current USDA standards for biobased materials content. The following exemptions may apply to the non-procurement of biobased content materials:

- A. The product does not meet appropriate performance standards;
- B. The product is not available within a reasonable time frame;
- C. The product is not available competitively (from two or more sources);
- D. The product is only available at an unreasonable price (compared with a comparable bio-based content product)."

Record each product used in the project that has a requirement or option of containing biobased content in accordance with SECTION 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, total value of biobased content, exemptions (a, b, c, or d, as indicated), and comments. Biobased content values may be determined by weight or volume percent but must be consistent throughout.

2.6 RECORD DRAWINGS

- A. Work included:
 - 1. Throughout progress of the work, the Contractor shall maintain, at the job or site, an accurate record of changes in the Contract Documents. The record of changes shall be kept current at all times and shall be accessible for periodic review by the AE and/or the Dept. of the Military.
 - 2. Transfer the recorded changes to a set of Record Documents to be provided to the AE prior to the final payment.
- B. Accuracy of records:
 - 1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.
 - 2. Accuracy of records shall be such that future searches for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.
- C. Entries on Drawings
 - 1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
 - 2. Date all entries.
 - 3. Call attention to the entry by a "cloud" drawn around the area or areas affected.
 - 4. In the event of overlapping changes, use different colors for the overlapping changes.
 - 5. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, is shown schematically and is not intended to portray precise physical layout.
 - a. Final physical arrangement is determined by the Contractor, subject to the AE's approval.
 - b. However, design of future modifications of the facility may require accurate information as to the final physical layout of items shown only schematically on the Drawings. This layout will be shown on the Record Drawings.
 - c. The AE may waive the requirements for conversion of schematic layouts where, in the AE's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the AE.
 - 6. Show on the Record Drawings, the following:
 - a. Clearly identify the item by note, such as "cast iron drain", "galv. water", and the like.

- b. Show, by the symbol or note, the vertical location of the item ("under slab", "in ceiling plenum", "exposed", and the like).
- c. Make all identification sufficiently descriptive that it may be related reliably to the Specifications.
- D. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of the work to proceed without lengthy and expensive site measurement, investigation and examination.
- E. Review and submittal:
 - 1. Contractor shall have Record Documents submitted in final form to the AE prior to or as an attachment with the notice of being substantially complete.

2.7 O&M MANUALS

- A. The Contractor shall prepare Operation and Maintenance Manuals in accordance with section 01 78 23 Operation & Maintenance Data within this project manual.
- B. Draft manuals shall be provided to the AE in sufficient time for thorough review.
- C. Contractor shall submit FINAL Operation and Maintenance Manuals to the AE prior to or as an attachment with the notice of being substantially complete.
- 2.8 REAL PROPERTY DATA FORM 1354 (FINAL)
 - A. The Contractor shall submit the Final Form 1354 data to the Owner prior to or as an attachment with the notice of being substantially complete.
 - B. Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. Contact the Project Manager for any project specific information necessary to complete the DD FORM 1354.
 - C. Completed DD FORM 1354 Attach the Real Property receiving Component's completed High Performance and Sustainable Building (HPSB) Checklist for each applicable building to the completed DD 1354, in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.
 - D. Completed Checklist Submit the completed Checklist for DD FORM 1354 of Installed Building Equipment items. Attach this list to the updated DD FORM 1354.

2.9 BUILDER DATA INFORMATION

A. Contractor shall submit a completed excel document provided by the Project Manager. All necessary information shall be documented along with electronic photographs of each piece of equipment or asset requiring photographic logging.

2.10 PRE-SUBSTANTIAL COMPLETION PUNCH LIST

- B. The AE may request a pre-substantial completion inspection punch list. This will consist of the AE and Contractor conducting a brief inspection of the project site to identify work items that need to be addressed or corrected before the project may be considered substantially complete.
- C. The Contractor shall record the items identified and generate of log of such items. The log shall note what was done to correct the identified issue, the Contractor that corrected the issue, and the date correction was completed.
- D. Contractor shall submit the pre-substantial completion punch list log prior to or as an attachment with the notice of being substantially complete.

2.11 COMMISSIONING ISSUES LOG

- A. During initial commissioning verification process the Commissioning Agent will develop a log of all issues found. The Commissioning Agent will provide a list of all items that need to be addressed to the Contractor.
- B. The Contractor shall create a log to track all items. The log shall indicated what was done to correct the identified issue, the Contractor that corrected the issue, and the date correction was completed.
- C. The Contractor shall have all identified issues resolved prior to requesting the Substantial Completion Inspection. The Contractor shall provide the Commissioning Issues Log to the Commissioning Agent and Owner for verification that all items have been completed.

2.12 FORMAL NOTICE OF SUBSTANTIAL COMPLETION

A. Once the Contractor believes they have met the requirements of Contract Documents and are substantially complete in accordance with the definition in General Conditions 10.1.3, the Contractor shall submit a formal

letter to the AE and Owner stating the project is substantially complete and ready for a substantial completion inspect.

- A. If the AE agrees that the project appears ready for the substantial completion inspection per Article 10 to the General Conditions, the AE shall recommend to the Dept. of the Military that a substantial completion inspection be conducted.
- B. If the Dept. of the Military agrees that the work is substantially complete they will schedule the substantial completion inspection within two (2) weeks of receipt of the AE's recommendation.
 - 1. Should the Contractor fail to submit any documentation required prior to or with the notice of being substantially complete the Substantial Completion Inspection will be delayed until submitted. Calendar days will continue to be counted against the project should Contractor fail to submit required documents on time.

2.13 CERTIFICATE OF SUBSTANTIAL COMPLETION

- A. Following the substantial completion inspection the AE will generate a punch list identifying all items noted during the inspection which require correction or attention by the Contractor.
- B. The AE will then draft the Certificate of Substantial Completion, attached the punch list, sign the certificate, and send the Certificate of Substantial Completion to the Contractor. The certificate shall be provided to the Contractor no more than 7 calendar days from the substantial completion inspection date.
 - 1. The following are considered acceptable Certificate forms:
 - A. Specification Section 00 65 16 Certificate of Substantial Completion Form
 - B. EJCDC C-625 Certificate of Substantial Completion
 - C. AIA G704 Certificate of Substantial Completion
 - 2. The certificate shall indicate the date in which the project was determined to be substantially complete, reference the punch list of items to be completed or corrected, and whether the entire project or specific portions of the project are considered substantially complete.
- C. Within 10 calendar days from determination that the project is substantially complete the Contractor shall provide the signed Certificate of Substantial Completion to the Owner.

2.14 PUNCH LIST VERIFICATION

- A. The Contractor shall provide the AE and Owner verification that all identified punch list items have been corrected/completed. This shall be done by producing a document identifying each punch list item, indicate what was done to correct the identified issue, the Contractor that corrected the issue, and the date correction was completed.
- B. The Contractor shall provide the punch list verification documentation to the AE and Owner as an attachment to their formal request for final inspection.

2.15 FORMAL NOTICE OF FINAL PROJECT COMPLETION

- A. The Contractor shall submit a formal letter to the AE and Owner requesting final inspection per Article 11 of the General Conditions.
- B. If the AE agrees that the project appears ready for the final inspection, the AE shall recommend to the Dept. of the Military that the final inspection be scheduled.
- C. If the Dept. of the Military agrees that the work is complete and in full compliance with the contract documents, they will schedule the final inspection within two (2) weeks of receipt of the AE's recommendation.

2.16 CERTIFICATE OF COMPLETION

- A. If the project is determined to be fully complete in accordance with the Contract Documents the AE will prepare the Certificate of Completion Specification Section 00 65 19 Certificate of Completion Form.
- B. The AE shall provide the certificate to the Contractor no more than 5 calendar days from the final completion inspection date.
- C. Within 10 calendar days from determination that the project is fully complete the Contractor shall provide the signed Certificate of Completion to the Owner.

2.17 UNEMPLOYMENT CONTRIBUTION CERTIFICATE

- A. The Contractor shall include with their final application for payment a State of South Dakota Unemployment Contribution Certificate.
- B. Final payment will not be processed until the certificate is provided to the Owner.

2.18 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall comply with the requirements established in General Condition's section 11.8.
- B. Once all work is fully complete and all required documentation has been submitted and approved the Contractor shall submit their Application for Final Payment.
- C. Included with the submittal shall be AIA Forms G706, G706A and G707 (or equivalent forms) and any other documentation required within the project manual.

PART 3 – EXECUTION

3.1 SUBSTANTIAL COMPLETION INSPECTION

- A. Reference Articles 10 and 11 of the General Conditions.
- B. The Substantial Completion Inspection will be conducted to review work of all trades.
 - 1. The Contractors is responsible to ensure all Subcontractors are present for the substantial completion inspection. Failure to have all Subcontractors present may be cause for the Dept. of the Military to postpone the substantial completion inspection.
- C. All parties will gather at the scheduled time and location as designated by the meeting invite. Instructions will be provided to the group as a whole.
- D. Based on project size, the inspection will be conducted as one group reviewing all aspects of the project or broken into multiple groups based on trade.
 - 1. Should the inspection be broken into multiple groups all participants will reconvene at the end of the inspection to discuss findings.
- E. The AE shall record all items of work that need to be corrector or completed in accordance with the Contract Documents.
- F. The AE and Owner will determine overall consensus if the project is substantially complete.
- G. Participants will determine the dollar value associated with all work items identified that need to be corrected or completed.
- H. In accordance with SD Codified Law twice the value of the remaining work will be withheld from payment.
- I. The AE will consolidate all item identified for correction or completion into a "Punch List".
- J. The AE shall provide the consolidated Punch List to the Contractor within 7 calendar days from the date of the inspection.

3.2 FINAL COMPLETION INSPECTION

- A. Reference Articles 10 and 11 of the General Conditions.
- B. A Final Completion Inspection will be conducted to review all items identified on the Punch List.
 - 1. It is the Contractors responsibility to assure all Subcontractors with work listed on the "punch list" are present for the final inspection. Failure to have all Subcontractors present may be cause for the Dept. of the Military to postpone the final inspection.
- C. All parties will gather at the scheduled time and location as designated by the meeting invite.
- D. All items on the Punch List will be inspected to ensure they have been completed in accordance with the Contract Documents.
- E. The project will only be determined to be Final Complete if all items have been corrected/completed in accordance with the Contract Documents.
 - 1. The Contractor's failure to complete all items prior to the Final Completion Inspection will require additional inspections to be conducted.
 - 2. The Contractor shall pay each AE fees for re-inspection of the project site due to their failure to complete all item prior to requesting a Final Completion Inspection.
- F. Once the project has been determined to be fully complete a Certificate of Completion will be prepared by the AE and circulated for signatures.

END SECTION 01 78 00

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01 78 23 OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 OVERVIEW

This section includes requirements for owner training along with operation and maintenance manual requirements.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM E1971 Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Operation and Maintenance Data
 - 1. O&M Database
 - 2. Training Plan
 - 3. Training Outline
 - 4. Training Content
- B. Closeout Submittals
 - 1. Training Video Recording
 - 2. Validation of Training Completion

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance.
- B. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions.
- C. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level.
- D. Include an index preceding each submittal.
- E. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.
- F. Package Quality
 - 1. Documents must be fully legible.
 - 2. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.
 - 3. Operation and Maintenance data must be submitted to the AE for quality review and approval prior to issuance to owner.
- G. Package Content
 - 1. Provide data package content in accordance with paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.
 - 2. Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows.
- H. Operation and Maintenance data must be submitted to the AE for inclusiveness review and approval prior to issuance to owner.
- I. Changes to Submittals
 - 1. Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.
- J. Commissioning Authority Review and Approval (if Cx is included with project)
 - 1. Submit the commissioned systems and equipment submittals to the Commissioning Authority (CxA) to review for completeness and applicability.
 - 2. Obtain validation from the CxA that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local

environmental impacts.

- 3. The CxA communicates deficiencies to the Owner.
- 4. Submit the O&M manuals to the owner upon a successful review of the corrections, and with the CxA recommendation for approval and acceptance of these O&M manuals. This work is in addition to the normal AE review procedures for O&M data.

1.5 INFORMATION REQUIRED IN O&M DATA PACKAGE

- A. Identification of Contractor and Subcontractors
- B. Index of Manual Sections
- C. Real Property Equipment
 - 1. Real property equipment shall be the first section of the Operation and Maintenance Manual.
 - 2. Provide a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: assigned equipment number, description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty.
 - 3. Provide spreadsheet listing all equipment with extended warranties.
 - a. List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, piece of equipment, description of item, location, manufacturer, duration, start date, end date, type of warranty, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.
 - 4. Facility Property Breakdown

National Guard Bureau requires certain infrastructure or systems to be quantified and associated pricing indicated for each identified item. Contractor shall provide installed quantity and the associated price with each on a Form 1354 (Form provided by owner).

D. Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

- 1. Safety Precautions and Hazards List personnel hazards and equipment or product safety precautions for operating conditions. Provide recommended safeguards for each identified hazard.
- 2. Operator Prestart Provide procedures required to install, set up, and prepare each system for use.
- 3. Startup, Shutdown, and Post-Shutdown Procedures Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.
- 4. Normal Operations Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.
- 5. Emergency Operations Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.
- 6. Operator Service Requirements Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.
- Environmental Conditions Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.
- 8. Operating Log Provide forms, sample logs, and instructions for maintaining necessary operating records.
- 9. Additional Requirements for HVAC Control Systems Provide Data Package 5 and the following for control systems:
 - a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
 - b. Full as-built sequence of operations.
 - c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).
 - d. Full points list. Provide a listing of rooms with the following information for each room:
 - 1) Floor
 - 2) Room number
- 3) Room name
- 4) Air handler unit ID
- 5) Reference drawing number
- 6) Air terminal unit tag ID
- 7) Heating or cooling valve tag ID
- 8) Minimum cfm
- 9) Maximum cfm
- e. Full print out of all schedules and set points after testing and acceptance of the system.
- f. Full as-built print out of software program.
- g. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.
- E. Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

- 1. Lubrication Data Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:
 - a. A table showing recommended lubricants for specific temperature ranges and applications.
 - b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
 - c. A Lubrication Schedule showing service interval frequency.
- 2. Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

- a. Define the anticipated time required to perform each of each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.
- 3. Cleaning Recommendations Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.
- F. Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1. Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

2. Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work in color. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

- Repair Procedures
 Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.
- 4. Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

5. Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

 Repair Work-Hours Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

G. Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

- 1. Product Submittal Data Provide a copy of Product Data submittals documented with the required approval.
- 2. Manufacturer's Instructions Provide a copy of Manufacturer's Instructions submittals documented with the required approval.
- 3. O&M Submittal Data Provide a copy of Operation and Maintenance Data submittals documented with the required approval.
- 4. Parts Identification Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, attachments, or accessories, such as typically shown in a master parts catalog.
- Warranty Information List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.
- 6. Extended Warranty Certificates.
- 7. Personnel Training Requirements Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.
- 8. Testing Equipment and Special Tool Information Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.
- Testing and Performance Data Include completed pre-functional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.
- 10. Field Test Reports Provide a copy of Field Test Reports submittals documented with the required approval.
- 11. Contractor Information Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.6 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGE

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

- A. Safety precautions and hazards
- B. Operator prestart
- C. Startup, shutdown, and post-shutdown procedures

- D. Normal operations
- E. Emergency operations
- F. Operator service requirements
- G. Environmental conditions
- H. Operating log
- I. Lubrication data
- J. Preventive maintenance plan, schedule, and procedures
- K. Cleaning recommendations
- L. Troubleshooting guides and diagnostic techniques
- M. Wiring diagrams and control diagrams
- N. Repair procedures
- O. Removal and replacement instructions
- P. Spare parts and supply list
- Q. Repair work-hours
- R. Product submittal data
- S. O&M submittal data
- T. Parts identification
- U. Warranty information
- V. Extended warranty information
- W. Personnel training requirements
- X. Testing equipment and special tool information
- Y. Testing and performance data
- Z. Contractor Information
- AA. Field test reports

PART 2 PRODUCTS

2.1 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance, startup reports, testing reports, and other record documentation. Include a complete electronically linked operation and maintenance directory.

A. Organization

Bookmark Product and Drawing Information documents using the current version of CSI Masterformat numbering system, and arrange submittals using the specification sections as a structure. Use CSI Masterformat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

B. CD or DVD Label and Disk Holder or Case
 Provide the following information on the disk label and disk holder or case: Operation & Maintenance Manual;
 Volume No. (if necessary); CFMO Project Name; CFMO#; Facility Name; Substantial Completion Date

2.2 OPERATION AND MAINTENANCE MANUAL BINDERS

- 1. Bound in 8-1/2" x 11" hard cover, indexed, loose leaf binder.
 - a. Information shall be folded, if necessary
- 2. Binders shall not exceed 3" in depth.
- 3. All sections and subsections will be provided with labeled index labs.
- 4. A sufficient number of binders shall be used so that each binder is less than 3/4 full.
- 5. Multiple binders shall be used if required to contain materials.
- 6. All binders shall be properly identified on Cover and Side with: O&M Manual; CFMO Project Name; CFMO #; Facility Name; Substantial Completion Date.
- 7. Contractor shall provide three (3) hard copies of all manuals produced.

2.3 TRAINING AUDIO/VIDEO FILES

- 1. All training videos shall be produced to be one composite electronically indexed file. Training videos shall be indexed in accordance with technical specification sections.
- 2. Audio and video shall be professional quality.
- 3. Provide three (3) copies each on data digital versatile disk (DVD).

- 4. All DVD's shall be labeled with: Training Videos; CFMO Project Name; CFMO#; Facility Name; Substantial Completion Date.
- 2.4 FORM 1354 REAL PROPERTY BREADOWN
 - 1. Contractor shall be provided a Form 1354 with identified infrastructure or systems along with the associated estimated quantities and units of measure.
 - 2. Contractor shall note any revisions to the quantities indicated on the form.
 - 3. Contractor shall provide furnished and installed pricing for each indicated item on the Form 1354.
 - 4. Within 14 calendar days following the date of acceptance of the project and prior to the final pay application, the Contractor shall submit the final document.

PART 3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility by the Owner for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Owner.

A. Training Plan

Submit a written training plan for approval at least 30 calendar days prior to the scheduled training. Training plan must be approved by the AE, Commissioning Authority (CxA), and Owner. Also, coordinate the training schedule with the AE, CxA, and Owner. Include within the plan the following elements:

- 1. Equipment included in training
- 2. Intended audience
- 3. Location of training
- 4. Dates of training
- 5. Objectives
- 6. Outline of the information to be presented and subjects covered including description
- 7. Start and finish times and duration of training on each subject
- 8. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)
- 9. Instructor names and instructor qualifications for each subject
- 10. List of texts and other materials to be furnished by the Contractor that are required to support training
- 11. Description of proposed software to be used for video recording of training sessions.
- B. Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The AE and CxA is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

- 1. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual/emergency operation, controls set-up and programming, troubleshooting, and alarms.
- 2. Relevant health and safety issues.
- 3. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.
- 4. Design intent.
- 5. Use of O&M Manual Files.
- 6. Review of control drawings and schematics.
- 7. Interactions with other systems.
- 8. Special maintenance and replacement sources.
- 9. Tenant interaction issues.
- C. Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 21 calendar days prior to the training.

D. Training Video Recording Record classroom training session(s) on video. Provide to the Owner three copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training. Audio shall be sufficient to clearly hear the presenter and participant questions on the recording when viewed as training.

E. Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Owner for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

F. Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Owner, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

-- END OF SECTION 01 78 23-

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01 78 24 FACILITY DATA REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

This specification requires the collection, organization, and turnover of electronic Facility Data for specific assets designed and constructed as part of this contract. Provide a Facility Document Set (FDS) and Facility Data Workbook (FDW) as defined in this specification. See Sections 01 33 00 SUBMITTAL PROCEDURES, 01 78 00 CLOSEOUT SUBMITTALS, and 01 78 23 OPERATION AND MAINTENANCE DATA, for additional Facility Data delivery requirements.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 19005-3Document Management -- Electronic Document File Format for Long-Term Preservation
-- Part 3: Use of ISO 32000-1 with Support for Embedded Files (PDF/A-3)ISO 32000-1Document Management -- Portable Document Format -- Part 1: PDF 1.7

1.3 DEFINITIONS AND ABBREVIATIONS

A. Assets

Assets are specific items of property or equipment.

- B. Attributes Attributes are individual pieces of Facility Data that describe facilities and their associated assets.
- C. Facility Data Information defined and collected in the Facility Data Workbook (FDW) and Facility Document Set (FDS).
- D. Facility Document Set (FDS) An electronically compiled and organized document containing the supporting documents and data used to populate the Facility Data Workbook during its respective phase of development.
- E. Facility Data Workbook (FDW) A pre-formatted spreadsheet template used to compile Asset, Attribute, Facility, and Space Data that the Owner wishes to manage via electronic means. The FDW also contains all requirements associated with proper collection, organization, and turnover of the Facility Data.
- F. Facility Data Project Execution Plan (FDPxP)
 A document that describes the clear and organized plan for the collection, organization, and turnover of the Facility Data deliverables required by this specification.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Preconstruction Submittals
 - 1. Facility Data Project Execution Plan (FDPxP)
- B. Operation and Maintenance Data
 - 1. Facility Data Workbook, Construction Progress
 - 2. Facility Document Set, Construction Progress
- C. Closeout Submittals
 - 1. Facility Data Workbook, Construction Final
 - 2. Facility Document Set, Construction Final
- 1.5 QUALITY CONTROL
 - A. Facility Data Project Execution Plan (FDPxP)

Provide the Owner with a plan for the collection, organization, and turnover of the Facility Data deliverables to the Owner. At a minimum, include the following items in the FDPxP:

1. Front Matter Provide a Cover Page, Table of Contents, and Executive Summary/Objectives. 2. Project Information

List the Project Owner, Project Name, Project Location and address, Contract Type, Project Description, Project/Contract Number, Project Milestones.

- Submittal Schedule
 Identify delivery schedule for all deliverables in compliance with the submission requirements identified
 in this specification.
- 4. Personnel

Identify key personnel involved in the development of the Facility Data deliverables including Contractor and Owner personnel.

5. Facility Data Workbook(s)

Identify Facility and Space Data as applicable at time of FDPxP submission. Individually list every asset group from the FDW Requirements that will require Facility Data collection. No attribute data is required at this time. Identify asset groups from the FDW Requirements that are not required within the scope of this Contract. Document the version of FDW to be used through the duration of the project.

6. Facility Document Set(s)

Define structure and format of the submittal. Provide a comprehensive outline of the final FDS to be delivered. Organize the outline with headings, titles, and descriptions such that the Owner may ascertain that working documents comply with the formatting requirements defined by this specification.

7. Protocols

Detailed procedures:

- a. Facility Data documentation/collection process.
- b. Facility Document Set production/development process.
- c. Collaboration procedures including strategy, meetings, communication, and subcontractor/consultant involvement.
- d. Quality Control, including site verification of FDW, as applicable.
- e. File and folder naming structure.
- f. Hardware and software being used for collection and organization of Facility Data. Identify type, format, and anticipated organization of digital storage media to be provided as part of required deliverables. Include means and methods for checking deliverables for malicious content.
- B. Meetings

To assure that Facility Data requirements are being met through the duration of the project, organize the following meetings and discuss the subsequent topics:

- 1. Pre-Construction Meeting
 - At a minimum, discuss the following:
 - a. The requirement for Facility Data deliverables under this contract.
 - b. Primary roles and responsibilities associated with the development and delivery of the Facility Data deliverables, and.
 - c. Identify and agree upon a date and attendance list for the meetings described below:
- 2. FDPxP Coordination Meeting
 - a. Facilitate a meeting following submission and Owner review of the FDPxP. Include the Facility Data Preparer(s), Designer of Record (DOR), Quality Control (QC) Manager, Commissioning Authority (CA), Owner's Facility Data Proponent, and Project Manager.
 - b. The purpose of this meeting is to coordinate the efforts necessary by contract parties to ensure an accurate collection, preparation, quality control, and submittal of these deliverables.
 - c. The FDPxP serves as the primary agenda for this meeting. At a minimum, discuss the following:
 - 1) Processes and methods of gathering facility data during construction. Discuss and obtain special permissions and waivers as necessary (such as photo waivers and data encryption);
 - 2) Contractor Quality Control practices and procedures;
 - 3) Corrective actions necessary for Owner approval of FDPxP;
 - 4) Necessity for additional or recurring Facility Data Coordination Meetings outside of those required by this specification, as requested by the Contractor. Intent of these meetings would be to maintain regular contact between responsible parties of the Contractor and Owner with regard to development of the facility data deliverables. Conduct status meetings with a frequency agreed upon at this meeting.
- 3. Submittal Coordination Meeting
 - a. Facilitate a meeting following submission and Owner review of each design or progress submittal of the Facility Data. Include the Facility Data Preparer(s), Designer of Record (DOR), Quality Control (QC)

Manager, Commissioning Authority (CA), Owner's Facility Data Proponent, Project Manager. Include Mechanical, Electrical, Plumbing, and Fire Protection subcontractors as applicable.

- b. The purpose of this meeting is to demonstrate ongoing compliance with the requirements identified in this specification.
- c. The applicable deliverables, along with Owner remarks associated with review of these submittals serve as the primary guide and agenda for this meeting. At a minimum, discuss the following during this meeting:
 - 1) Review assets, applicable attributes, facility, and space data in FDW at time of submittal;
 - 2) Demonstrate Quality Control and site verification procedures, as applicable, by Contractor QC;
 - 3) Review contents and organization of FDS at time of submittal;
 - 4) Discuss Owner review comments and unresolved items preventing completion and Owner approval of the Facility Data Workbook and Facility Document Set.
- C. Facility Turnover and Contract Closeout

Include the Facility Document Set, Construction Final as a deliverable in Facility Turnover and Contract Closeout procedures as defined in 01 78 00 CLOSEOUT SUBMITTALS.

D. Facility Data Workbook Quality Requirements

For each submittal, ensure that the information contained in the FDW(s) reflects the minimum content requirements defined in the PART 3 EXECUTION portion of this section. Ensure that information provided as part of the FDW(s) conforms to the standards described below:

- 1. Compile FDW(s) using approved spreadsheet templates. Do not alter the formatting or organizational layout of the templates. Editable copies of the templates will be provided upon Contract Award.
- 2. Instructions for the proper maintenance and completion of these FDWs are contained in the FDW Requirements contained within the FDW template.
- E. Facility Document Set Quality Requirements

Ensure that information provided as part of each FDS conforms to the electronic and data formatting standards identified in 01 33 00 SUBMITTAL REQUIREMENTS and 01 78 23 OPERATION AND MAINTENANCE DATA.

1. Document Files

Utilize PDF file format in accordance with ISO 32000-1 and ISO 19005-3 for all document-based files. Provide files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution. Bookmark and label files as defined in the PART 2 PRODUCTS portion of this section.

2. Photograph Files

If photographs are required, utilize JPEG file format for all photograph and image files. Provide full-color photos with photo resolution of not less than 4 megapixels and not more than 12 megapixels. Provide a copy of installation-specific letters or waivers allowing permission to take installed equipment photographs on this Contract. Waivers need not be attached to every photo, only one copy of each permission letter need be included in the Owner deliverables.

3. Drawing Files

Provide all drawings required by this specification in full-size PDF format in accordance with ISO 32000-1 and ISO 19005-3. Produce PDF files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution whenever possible. Bookmark and label files as defined in the PART 2 PRODUCTS portion of this section. Submission of scanned or photocopied drawing files is prohibited. Only vector-preserved PDF files are acceptable.

F. Facility Document Set Integrity Requirements

Ensure that information provided as part of each FDS conforms to the integrity standards identified below:

1. File Protection

Do not restrict data files, document files or photographic files from being printed, exported, modified or copied. Do not deliver files with restrictions such as expiration date and locks for access, viewing, archiving, or editing.

2. Manufacturer-Specific Documents

Provide text-searchable, vector-based document files from the manufacturer's online or electronic documentation. Color documents are preferred. Provide documents specific to the product(s) installed under this Contract. When possible, do not submit document files containing multiple product catalogs from the same manufacturer, or product data from multiple manufacturers in the same file. Provide documents directly from the manufacturer whenever possible. Do not provide scanned copies of hardcopy documents.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver facility data submittals in an organized and legible manner. Provide submittals adhering to the requirements of 01 33 00 SUBMITTAL REQUIREMENTS and 01 78 23 OPERATION AND MAINTENANCE DATA described below.

A. Number of Copies

Provide three identical copies of disks for approval; for each submittal and each facility required. Provide on approved electronic media (one copy per disk or set of disks) as defined below. Provide submittal files on electronic storage media in compliance with the quality requirements identified in this specification.

- B. Malicious Content Scan all files for malicious viruses using a commercially available scanning program that is routinely updated to identify and remove current virus threats.
- C. Storage Media
 - Provide facility data on disk-based (DVD-R/RW) media. Deviations from the required storage media must be approved by the Owner. Select and apply technology used for electronic data transmission to ensure that the full Facility Data submittal for each facility is provided on one single disk, whenever possible. When separation of the submittal is required, first separate the FDS and the FDW onto separate media. Second, separate FDS into logical segments or components. Further divisions must be documented in the FDPxP and approved by the Owner.
 - 2. Provide Facility Data on disk-based (DVD-R/RW) media. Deviations from the required storage media must be approved by the Owner. Select and apply technology used for electronic data transmission to ensure that the full Facility Data submittal for each facility is provided on one single disk, whenever possible. When separation of the submittal is required, first separate the FDS and the FDW onto separate media. Second, separate FDS into logical segments or components. Further divisions must be documented in the FDPxP and approved by the Owner.
 - a. Apply a label directly printed to storage media. Do not provide adhesive, paper-based labels. List the name of the facility, Project, Project location, Contract number, Designer of Record firm/Prime Contractor company's name, title of submission, and security classification (in accordance with the appropriate security classification labeling regulations) on the label. If multiple disks are provided, clearly document the contents of each disk on the label.
 - b. Include the name and contact information of the individual who produced the final data disk to ensure that problems with the data or media can be easily resolved.
 - c. When browsed on a computer, the disk must display the following folders and their associated content:
 - 1) Facility Data Workbook (containing 1 FDW per facility);
 - 2) Facility Document Set (containing 1 FDS per facility);
 - 3) FDPxP (containing 1 PxP per contract);
 - 4) Readme (Containing 1 TXT, PDF, or HTML file with general use information, organizational instructions, and basic preparer contact information. Include all information included on the storage media label).

PART 2 PRODUCTS

2.1 FACILITY DATA WORKBOOK(S)

Provide one compiled FDW for each facility identified above. Complete all portions of each FDW including facility, space, asset, and attribute data in compliance with the FDW Requirements. An FDW with pre-populated basis-of-design information is attached to this section. The Owner will provide electronic copy of the attached FDW(s) to the Contractor upon award.

A. Spaces

Provide data for all applicable spaces in the facility. Minimum space definitions are as follows:

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- 1. Provide all rooms as defined in the design documents.
- 2. If not otherwise defined, provide a minimum of one "roof" space in the FDW.
- 3. If not otherwise defined, provide a minimum of one "site" space in the FDW.
- 4. Provide all spaces not otherwise described, but necessary to accurately indicate the location of all FDW assets required by this specification.

B. Assets

1. Compile an FDW that contains the maintainable and warrantable equipment (assets) associated with each facility. This includes assets in contract scope and within the project extents. See 01 78 00 CLOSEOUT

SUBMITTALS and 01 78 23 OPERATION AND MAINTENANCE DATA for related requirements. Assets include, but are not limited to, those types described in the "Required Assets" portion of the FDW template and additional assets defined in the FDPxP. Itemized FDW asset entries (instance-based). Entries indicative of multiple assets (type-based) are not allowed. Document assets applicable to the scope of this project in the FDPxP.

- 2. Sub-component assets that are an integral and functional part of another component (e.g. An electric motor that serves as part of an air-handling unit) need not be duplicated or listed separately as its own asset.
- 3. Definitions, descriptions, and formatting requirements for these assets can be found in the FDW Requirements contained within the FDW template.
- 4. If an asset type is not included in the scope of the Project, no Facility Data (assets or attributes) are to be included in the FDW (even as a placeholder) for that asset type.

C. Attributes

- 1. Populate each individual asset with all required attributes defined in the "Required Attributes" portion of the FDW template.
- 2. Definitions, descriptions, and formatting requirements for these attributes can be found in the FDW Requirements contained within the FDW template.
- 3. If an attribute is not applicable, populate that field with "N/A". Do not leave it blank.

2.2 FACILITY DOCUMENT SET

A. Organization

Organize the FDS in a hierarchical manner as follows. Use electronic bookmarks to create an easily navigable document. The first and primary hierarchical level must contain the following bookmarks:

- 1. "O&M Data" See subordinate hierarchical requirements in the "O&M DATA HIERARCHY" paragraph.
- 2. "Record Drawings" See subordinate hierarchical requirements in paragraph RECORD DRAWINGS HIERARCHY.
 - a. O&M Data Hierarchy

Under "O&M Data" provide all Owner-Approved O&M Data Packages as defined in 01 78 23 OPERATION AND MAINTENANCE DATA and as required by technical specifications contained within this contract. Further organize this information under the following hierarchical levels:

- 1) The contract specification and title under which the Data Package and the associated equipment or system references.
- 2) The Data Package Number as defined in 01 78 23 OPERATION AND MAINTENANCE DATA.
- 3. Record Drawings Hierarchy

Under "Record Drawings" provide an electronic copy of the Owner-Approved record drawings, as specified in 01 78 00 CLOSEOUT SUBMITTALS, for the project in PDF format. Further group discipline sheets under the following hierarchical levels:

- The full discipline heading represented by the contents of the sheet and as shown in the Record Drawing Sheet Index. Organize these headings in the order that the drawings set is organized. (General, Civil, Structural, Architectural, Interiors, Plumbing, Mechanical, Electrical, Telecommunications)
- b. The Sheet ID and Sheet Name as found in the Record Drawing Sheet Index and in accordance with the AEC CAD Standard referenced in 01 78 00 CLOSEOUT SUBMITTALS. (e.g. G-001 - LEGEND; CS101 - SITE PLAN AREA 101; A-101 - OVERALL FIRST FLOOR PLAN; P-601 - FIRST FLOOR DWS WATER RISER DIAGRAM)

PART 3 EXECUTION

3.1 CONSTRUCTION PROGRESS SUBMITTALS

Submit the FDW and FDS construction progress submittals together. Meet the following completeness and formatting requirements listed below:

A. Provide Facility Data Workbook, Construction Progress submittal(s) when all assets are identified, but not later than 30 days prior to Date of Substantial Completion as identified in the Owner-Approved construction schedule. Clearly identify assets or asset groups missing in the "variations" section of the ENG Form 4025 Transmittal Form provided with the submittal. Populate assets with front-loaded attribute data that is available at the time of asset input. See the FDW Requirements contained within the FDW template for a list of attributes to be completed for this submittal.

- B. Submit individual FDW templates for each facility identified in the "FACILITIES" paragraph. While FDWs are not required to be complete for this submittal, provide accurate and correctly formatted data according to the FDW Requirements.
- C. Submit a sample or working Facility Document Set, Construction Progress submittal containing "draft" or "example" documents that are organized in the manner defined by this specification. Draft or example documents need not be technically accurate or complete in their content but defined and separated in a manner such that all organizational and formatting requirements defined by this specification may be evaluated.

3.2 CONSTRUCTION FINAL SUBMITTALS

Submit the FDW and FDS construction final submittals as they are completed. Coordinate the Facility Data Workbook, Construction Final submittal with data verification procedures as defined in the accepted FDPxP. Provide the Facility Document Set, Construction Final submittal only after Owner acceptance of its individual components as defined by 01 78 00 CLOSEOUT SUBMITTALS and 01 78 23 OPERATION AND MAINTENANCE DATA.

3.3 FACILITY DATA WORKBOOK VERIFICATION

Verify the FDW through the quality control personnel and procedures as defined in the FDPxP. One-hundred percent accuracy of FDW information is required for Owner acceptance of the Facility Data Workbook and Facility Data Workbook, Construction Final submittal.

-- END OF SECTION 01 78 24--

02 21 13 SITE SURVEYS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Researching and collecting documents informing surveys.
 - 2. Performing boundary survey, topographic survey, and utility survey.
 - 3. Creating survey drawings.

1.2 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Land Title Association and American Congress on Surveying and Mapping (ALTA-ACSM):
 1. Accuracy Standards for ALTA-ACSM Land Title Surveys.
- C. Federal Geographic Data Committee (FGDC):
 - 1. STD-007.03 Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy.
 - 2. STD-007.04 Geospatial Positioning Accuracy Standards Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management.

1.3 SUBMITTALS

- A. Survey Drawings:
 - 1. Prints: Two sets of black line, full size prints of each drawing.
 - 2. Electronic Files: Consistent with United States National Computer-Aided Design (CAD) Standards and SDARNG PAM 420-10-3.

1.4 QUALITY ASSURANCE

- A. Land Surveyor: One of the following:
 - 1. Experienced professional land surveyor licensed in state in which project is located.
 - 2. Experienced professional civil engineer licensed in state in which project is located and authorized to practice land surveying as civil engineer.

PART 2 - PRODUCTS

2.1 ACCESSORIES

- A. Monuments: Iron pin, with driven 5/8 inch diameter, minimum 24 inches long to prevent displacement.
- B. Stakes: Hardwood.
- C. Flagging: Plastic, roll form, highly visible, solid color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Research public and facility records for deeds, maps, monuments, plats, surveys, title certificates or abstracts, rights-of-way, easements, section line, other boundary line locations, and other documents pertaining to project site.
- B. Research public and facility utility records for aerial, surface, and subgrade structures and utility service lines and easements.

3.2 PREPARATION

- A. Coordinate with Contracting Officer's Representative for site access.
- B. Coordinate with adjacent property owners when access to adjoining properties is required.
 - 1. Notify Contracting Officer's Representative when access is denied.

3.3 SURVEYS

- A. Perform survey on ground according to Accuracy Standards for ALTA-ACSM Land Title Surveys and FGDC STD-007.3 and FGDC STD-007.4.
- B. Boundary Survey:
 - 1. Locate permanent monuments within and along survey boundary.
 - 2. Set permanent monument at property corners when monument is not found.
 - 3. Temporarily mark monument locations with stake and flagging.
 - 4. Reconcile differences between legal description and survey.
- C. Topographic Survey:
 - 1. Vertical Control: National Geodetic Survey or existing benchmark.
 - 2. Establish minimum three permanent benchmarks plus one permanent benchmark for each 4 acres within survey boundary.
 - 3. Determine project site contours at maximum 1 foot interval.
 - 4. Determine spot elevations at specified locations.
- D. Utility Survey:
 - 1. Locate piped utilities and utility structures. Identify service type, sizes, depths, and pressures.
 - 2. Locate fire hydrants.
 - 3. Locate wired utilities and utility structures. Identify service type, rated capacities, and elevations above and below grade.
 - 4. Identify each utility authority including contact person and phone number.
- E. Locate permanent structures within survey boundary by perpendicular dimension to property lines.
 - 1. Determine structure plan dimensions, heights, and vertical offsets.
 - 2. Determine projections and overhangs beyond structure perimeter at grade.
 - 3. Determine number of stories and primary building materials.
- F. Locate rights-of-way and easements within and adjacent to survey boundary by perpendicular dimension to property line.
 - 1. Locate project site access from rights-of-way by dimension from survey monument. Determine site access width.

3.4 SURVEY DRAWING REQUIREMENTS

- A. Consult Contracting Officer's Representative to confirm required survey scale and drawing size.
 - 1. Drawing Size: Maximum 30 by 42 inches.
 - 2. Boundary Survey Scale: Maximum 1 inch equals 30 feet.
 - 3. Enlarged Detail Areas: Scale as required to present dimensional data and survey information clearly. Maintain orientation aligned with smaller scale view.
 - 4. Plan Orientation: North at top of drawing sheet.
- B. Drawing Notations:
 - 1. Land Surveyor: Name, address, telephone number, signature, seal, and registration number.
 - 2. Survey Dates: Date survey was initially completed and subsequent revision dates.
 - 3. Certification: Certify each drawing adjacent to land surveyor's seal:
 - a. "I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to provide complete and accurate information."
 - b. Title, number, and total number of drawings on each drawing.
 - c. Scale in metric and imperial measurement.
 - d. Graphic scale in metric and imperial measurement.
 - e. Graphic symbol and abbreviation legends.
 - f. North arrow for plan view drawings.
 - g. Benchmark locations.
 - h. Horizontal and vertical control datum.
 - i. Adjacent property owner names.
 - j. Zoning classifications.
 - k. Building street numbers.
 - 4. Evidence of Possession: Indicate character and location of evidence of possession affecting project site. Notation absence signifies no observable evidence of possession.
- C. Vicinity Map: Indicate project site and nearby roadways and intersections.
- D. Record Documents Forming Survey Basis: Indicate titles, source, and recording data of documents relied upon to complete survey.

- E. Legal Description: Recorded title boundaries.
- F. Land Area: Report in Square Feet when site is less than half (0.499) an acre and in Acres when site is a half (0.5) or more as defined by the boundaries of the legal description of the surveyed premises, including legal description of the land.
 - 1. Accuracy: 1 sq. ft. or 0.001 acres.
- G. Boundary Lines: Show point of beginning, length and bearing for straight lines, and angle, radius, point of curvature, point of tangency, and length of curved lines.
 - 1. Include bearing basis and data necessary to mathematically close survey.
 - 2. When recorded and measured bearings, angles, and distances differ, indicate both recorded and measured data.
 - a. Indicate when recorded description does not mathematically close survey.
 - 3. Indicate found and installed monuments establishing basis of survey.
 - 4. Contiguity, Gores, and Overlaps: Identify discrepancies within and along survey boundary.
- H. Lots and Parcels: Indicate entire lots and parcels included within and intersected by survey boundary.
- I. Roadways: Indicate names and widths of rights-of-way and roadways within and abutting survey boundary.
 - 1. Indicate changes in rights-of-way lines either completed or proposed.
 - 2. Indicate accesses to roadways.
 - 3. Indicate abandoned roadways.
 - 4. Indicated unopened dedicated roadways.
- J. Setbacks: Indicate recorded setback and building restriction lines.
- K. Structures and Site Improvements: Indicate buildings, walls, fences, signs, and other visible improvements.
 - 1. Indicate each building dimensioned to property lines and other structures.
 - 2. Indicate exterior dimensions of buildings at ground level. Show area of building footprint and gross floor area of entire building.
 - 3. Indicate maximum measured height of buildings above grade, point of measurement, and number of stories.
 - 4. Indicate spot elevations at building entrances, first floor, service docks, corners, steps, ramps, and grade slabs.
 - 5. Indicate structures and site improvements within 5 feet of survey boundary.
 - 6. Indicate encroachments on project site, adjoining property, easements, rights-of-way, and setback lines from fire escapes, bay windows, windows and doors opening out, flue pipes, stoops, eaves, cornices, areaways, stoops, other building projections, and site improvements.
 - 7. Identify setback, height, and floor space area restrictions set by applicable zoning and building codes and recorded subdivision maps. Indicate if no restrictions exist.
- L. Easements:
 - 1. Indicate easements evidenced by recorded documents.
 - a. Indicate when easements cannot be located.
 - 2. Indicate observable easements created by roadways, rights-of-ways, water courses, drains, telephone, telegraph, electric and other wiring, water, sewer, oil, gas, and other pipelines within project site and on adjoining properties when potentially affecting project site.
 - 3. Indicate observable surface improvements of underground easements.
- M. Pavements:
 - 1. Indicate location, alignment, and dimensions for vehicular and pedestrian pavements.
 - 2. Indicate pavement encroachments from adjacent properties onto project site and onto adjacent properties from project site.
 - a. Dimension encroachments from survey boundary.
 - 3. Indicate roadway centerlines with true bearings and lengths by 50 feet stationing.
 - a. Describe curves by designating points of curvature and tangency. Include curve data and location of radius and vertex points.
 - b. Indicate elevations at station points along roadway centerlines, roadway edges, and top and bottom of curbs.
 - 4. Indicate parking areas, parking striping, and total parking spaces.
 - 5. Indicate curb cuts, driveways, and other accesses to public ways.
- N. Indicate cemetery and burial ground boundaries.
- O. Waterways:
 - 1. Indicate boundaries of ponds, lakes, springs, and rivers bordering on or running through project site. Note date of measurement and that boundary is subject to change due to natural causes.
 - 2. Indicate flood plain location and elevation.

- 3. Indicate watershed extent affecting project site.
- P. Indicate topographic contours.
- Q. Flood Zone: Indicate applicable flood zone from Federal Flood Insurance Rate Maps, by scaled map location and graphic plotting.
- R. Public and Private Utilities:
 - 1. Indicate information source and operating authority for each utility.
 - 2. Indicate utilities existing on or serving project site.
 - 3. Indicate fire hydrants on project site and within 500 feet of survey boundary.
 - 4. Indicate manholes, catch basins, inlets, vaults, and other surface indications of subgrade services.
 - 5. Indicate depths or invert elevations, sizes, materials, and pressures of utility pipes.
 - 6. Indicate wires and cables serving, crossing, and adjacent to project site.
 - 7. Indicate exterior lighting, traffic control facilities, security, and communications systems.
 - 8. Indicate utility poles on project site and within 10 feet of survey boundary.
 - 9. Indicate dimensions of cross-wires or overhangs affecting project site.
- S. Observable Evidence:
 - 1. Indicate in-progress and recently completed earth moving work, building construction, and building additions.
 - 2. Indicate in-progress and recently completed pavement construction and repairs.
 - 3. Indicate areas used as solid waste dump, sump, and sanitary landfill.
- T. Trees:
 - 1. Indicate individual trees with minimum 6 inches diameter measured at 48 inches above grade.
 - 2. Indicate wooded area perimeter outline and description of predominant vegetation.

END OF 02 21 13

DIVISION 02 – SITE CONSTRUCTION

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Removal of identified items/materials within the Construction Plans.
- B. Unless identified to be salvaged, all items shall become property of the Contractor.
- C. Contractor shall properly dispose of all items in accordance with Section 01 74 19 -Construction Waste Management, or in accordance with local, State, and Federal laws.
- D. Salvaged items shall remain in the same condition as existing. Salvaged items may be designated to be re-installed or turned over to the SDARNG for reuse at a later date. Items designated to be salvaged that are damaged during Contractor's removal or storage of the item shall be replaced or repaired by the Contractor at no cost to the SD Dept. of the Military.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced with the crafts necessary for proper performance of demolition work described herein and as shown on the Plans. Workers shall be familiar with specified requirements.
- PART 2 PRODUCTS Not Used

PART 3 – EXECUTION

3.1 PROTECTION

A. Contractor shall implement measures to prevent damage to adjacent construction, equipment, etc. that is to remain in place and intact.

3.2 EXISTING CONDITIONS

A. Contractor shall examine the areas and conditions under which demolition work will take place. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.3 DEMOLITION

- A. Contractor shall thoroughly examine the contract documents, determine exact location and extent of selective demolition to be preformed.
- B. Remove items identified on the Construction Plans.

3.4 REPLACEMENTS

A. Contractor shall repair and/or replace adjacent construction, equipment, etc. damaged or removed due to demolition activities. Repair and/or replacement shall be at the Contractor's expense and no reimbursement or compensation shall be provided. END SECTION 02 41 19

DIVISION 02 – SITE CONSTRUCTION

SECTION 02 41 19 SELECTIVE DEMOLITION

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SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings, foundation walls and slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

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

- 1. Cementitious materials.
- 2. Admixtures.

Α.

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

- 3. Fiber reinforcement.
- 4. Curing compounds.
- 5. Floor and slab treatments.
- 6. Bonding agents.
- 7. Adhesives.
- 8. Vapor retarders.
- B. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- 1.9 FIELD CONDITIONS
 - A. 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.
 - B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

- 2.1 CONCRETE, GENERAL
 - A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that 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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- G. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, 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.

2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. 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.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M, Type I/II or IL, gray.
 - 2. Fly Ash: ASTM C618, Class F.

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- F. Water: ASTM C94/C94M and potable.

2.6 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, 3/4 to 1-1/2 inches long.
- 2.7 VAPOR RETARDERS
 - A. Sheet Vapor Retarder: ASTM E1745, Class A, 10 mil minimum.. Include manufacturer's recommended adhesive or pressure-sensitive tape.
- 2.8 CURING MATERIALS
 - A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
 - C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
 - D. Water: Potable.
 - E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

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2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

Footings and Foundation Walls: Normal-weight concrete.

- 1. Minimum Compressive Strength: 4000 psi at 28 days.
- 2. Maximum W/C Ratio: 0.45.
- 3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
- 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- B. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.

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- 3. Minimum Cementitious Materials Content: 540 lb/cu. yd..
- 4. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
- 5. Air Content (exterior slabs): 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- 6. Air Content (interior slabs): Do not allow air content of trowel-finished floors to exceed 3 percent.
- 7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd..

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- 2.14 CONCRETE MIXING
 - A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
 - When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- 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. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct 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.

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3.2 EMBEDDED ITEM INSTALLATION

- 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 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 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 support weight of concrete in place until concrete has achieved at least 70 percent of 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 are not 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.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 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.

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- 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
- 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
- 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
- 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- 7. 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. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
 - 1. 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 is 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 not to 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

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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.

3.8 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 receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bullfloated 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 orto receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo .
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
 - 2. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface:

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- a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
- 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 thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- 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 inplace 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:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported 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.

3.11 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 305.1 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 remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

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- 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
- 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- 4. 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.
- 3.12 JOINT FILLING
 - A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
 - B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
 - C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding

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agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

- 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Headed bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.

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- 5. Curing procedures and maintenance of curing temperature.
- 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C31/C31M.
 - a. Cast and laboratory cure standard cylinder specimens for each composite sample using one of the following:
 - 1) 6x12 cylinder specimens: Cast 4 cylinders.
 - 2) 4x8 cylinder specimens; Cast 5 cylinders.
 - 6. Compressive-Strength Tests: ASTM C39/C39M; for 6x12 cylinders, test one specimen of laboratory-cured specimen at 7 days, two specimens at 28 days, and hold one specimen for control; for 4x8 cylinders, test one specimen of laboratory-cured specimens at 7 days, three specimens at 28 days, and hold one specimen for control.
 - a. A compressive-strength test shall be the average compressive strength from a set of of specimens obtained from same composite sample and tested at age indicated.
 - 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 - 8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 - 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 - 10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 - 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

D. Measure floor and slab flatness and levelness according to ASTM E1155 within 24 hours of finishing.

END OF SECTION 03 30 00

SECTION 04 01 20.63 BRICK MASONRY REPAIR

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. Repairing brick masonry, including replacing units.

1.3 DEFINITIONS

- A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- B. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- C. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

1.4 SEQUENCING AND SCHEDULING

- A. Work Sequence: Perform brick masonry repair work in the following sequence, which includes work specified in this and other Sections:
 - 1. Inspect masonry for open mortar joints and apply helical stich ties where required. Point joints before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - 2. Clean masonry.
 - 3. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 - 4. Repair masonry, including replacing existing masonry with new masonry materials.
 - 5. Rake out mortar from joints to be repointed.
 - 6. Point mortar and sealant joints.
 - 7. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
 - 8. Where water repellents are to be used on or near masonry work, delay application of these chemicals until after pointing and cleaning.
- B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units according to "Masonry Unit Patching" Article. Patch holes in mortar joints according to Section 04 01 20.64 "Brick Masonry Repointing."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Samples for Initial Selection: For the following:
 - 1. Colored Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, 6 inches (150 mm) long by 1/4 inch (6 mm) wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - 2. Include similar Samples of accessories involving color selection.
- C. Samples for Verification: For the following:

SECTION 04 01 20.63 BRICK MASONRY REPAIR

- 1. Each type of brick unit to be used for replacing existing units. Include sets of Samples to show the full range of shape, color, and texture to be expected. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.
- D. Test Reports:
 - 1. Preconstruction test results for existing masonry mortar and units.
 - 2. Recommended mortar mix and mortar materials sources.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications
 - 1. Documented experience in completion of work, similar in design, material and extent specified.
- B. Preconstruction testing:
 - 1. Existing brick: according to ASTM C67.
 - 2. Existing mortar: according to ASTM C295/C295M.
 - a. Recommend mortar mix compatible with existing and mortar material sources required to match existing color and texture.
- C. Mockups: Prepare mockups of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.
 - 1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - a. Replacement: Four brick units replaced.
 - b. Patching: Three small holes as directed for each type of brick indicated to be patched.
 - c. Repointing three courses of brick for at least a 24" run.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavyduty cartons and protected against impact and chipping.
- B. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- F. Handle masonry units to prevent overstressing, chipping, defacement, and other damage.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit brick masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.

DIVISION 04 - MASRONY

SECTION 04 01 20.63 BRICK MASONRY REPAIR

- B. Temperature Limits, General: Repair masonry units only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
- C. Cold-Weather Requirements: Comply with the following procedures for masonry repair unless otherwise indicated:
 - 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for seven days after repair.
- D. Hot-Weather Requirements: Protect masonry repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
- E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

PART 2 - PRODUCTS

- 2.1 MATERIALS, GENERAL
- 2.2 MASONRY MATERIALS
- A. Face Brick: Provide shapes indicated as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - a. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick
- 2.3 MORTAR MATERIALS
 - A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for coldweather construction; white where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
 - B. Hydrated Lime: ASTM C 207, Type S.
 - C. Mortar Cement: ASTM C 1329/C 1329M.
 - D. Mortar Sand: ASTM C 144.
 - 1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 - E. Mortar Pigments: ASTM C 979/C 979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
 - F. Water: Potable.

2.4 ACCESSORY MATERIALS

- A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units, less the required depth of pointing materials unless removed before pointing.
- B. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- C. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to MPI #23 (surface-tolerant, anticorrosive metal primer).

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1. Surface Preparation: Use coating requiring no better than method required to remove scale. Follow surface preparation according to manufacturer's literature or certified statement.

2.5 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
- B. Do not use admixtures in mortar unless otherwise indicated.
- C. Mixes: Mix mortar materials in the proportions to match properties of existing mortar to remain, including adhesion, strength and appearance.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 - 2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
 - 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.

3.2 MASONRY REPAIR, GENERAL

A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.

3.3 ABANDONED ANCHOR REMOVAL

- A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain.
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. Notify Architect before proceeding if an item cannot be removed without damaging surrounding masonry. Do the following where directed:
 - a. Cut or grind off item approximately 3/4 inch (20 mm) beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - 3. Patch hole where each item was removed unless directed to remove and replace masonry unit.

3.4 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - 1. When removing single bricks, remove material from center of brick and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition. Coordinate with new flashing, reinforcement, and lintels, which are specified in other Sections.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
 - 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
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- 2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
- 3. Store brick for reuse. Store off ground, on skids, and protected from weather.
- 4. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - 1. Maintain joint width for replacement units to match existing joints.
 - 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- H. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.) Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 - 2. Rake out mortar used for laying brick before mortar sets according to Section 04 01 20.64 "Brick Masonry Repointing." Point at same time as repointing of surrounding area.
 - 3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
 - 4. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.5 PAINTING STEEL UNCOVERED DURING THE WORK

- A. Notify Architect if steel is exposed during masonry removal. Where Architect determines that steel is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
 - 1. Surface Preparation: Remove paint, rust, and other contaminants to the extent required to comply with paint manufacturer's recommended preparation.
 - 2. Antirust Coating: Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
- B. If on inspection and rust removal, the thickness of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify Architect before proceeding.

3.6 CLEANING

- A. Remove mortar splatter from exposed surfaces immediately.
- B. Clean exposed masonry surfaces on completion.
- C. Remove mortar droppings and other foreign substances from wall surfaces.
- D. Wet surfaces with clean water.
- E. Wash with cleaning agent.
- F. Brush masonry surfaces with stiff fiber brushes while washing.
- G. Immediately after washing, rinse with clean water.
 - 1. Remove traces of detergent, foreign streaks or stains.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
- B. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- C. Notify inspectors and Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and

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Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

- 3.8 MASONRY WASTE DISPOSAL
 - A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property.
 - B. Masonry Waste: Remove masonry waste and legally dispose of off Owner's property.

END OF SECTION 04 01 20.63

SECTION 04 01 20.64 BRICK MASONRY REPOINTING

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. Repointing joints with mortar.
- 2. Repointing joints with sealant.

1.3 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.4 SEQUENCING AND SCHEDULING

- A. Work Sequence: Perform brick masonry repointing work in the following sequence, which includes work specified in this and other Sections:
 - 1. Inspect masonry for open mortar joints and permanently or temporarily point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - 2. Clean masonry.
 - 3. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 - 4. Repair masonry, including replacing existing masonry with new masonry materials.
 - 5. Rake out mortar from joints to be repointed.
 - 6. Point mortar and sealant joints.
- B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units according to Section 04 01 20.63 "Brick Masonry Repair." Patch holes in mortar joints according to "Repointing Masonry" Article.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Samples for Initial Selection: For the following:
 - 1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches (150 mm) long by 1/4 inch (6 mm) wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.
 - 2. Sealant materials.
 - 3. Sealant materials.

1.6 QUALITY ASSURANCE

- A. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.
- B. Mockups: Prepare mockups of brick masonry repointing to demonstrate aesthetic effects and to set quality standards for materials and execution.

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- 1. Repointing: Rake out joints in two separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide for each type of repointing required, and repoint one of the areas.
- 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- D. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repointing work to be performed according to product manufacturers' written instructions and specified requirements.
- B. Temperature Limits, General: Repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
- C. Cold-Weather Requirements: Comply with the following procedures for mortar-joint pointing unless otherwise indicated:
 - 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for seven days after pointing.
- D. Hot-Weather Requirements: Protect mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of material for repointing brick masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.
- 2.2 MORTAR MATERIALS
 - A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for coldweather construction; white or gray, or both where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
 - B. Hydrated Lime: ASTM C 207, Type S.
 - C. Mortar Cement: ASTM C 1329/C 1329M.
 - D. Mortar Sand: ASTM C 144.

SECTION 04 01 20.64 BRICK MASONRY REPOINTING

- 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- 2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- E. Water: Potable.

2.3 ACCESSORY MATERIALS

- A. Sealant Materials:
 - 1. Sealant manufacturer's standard elastomeric sealant(s) of base polymer and characteristics indicated below and according to applicable requirements in Section 07 92 00 "Joint Sealants."
 - a. Type: Single-component, nonsag urethane sealant.
 - 2. Colors: Provide colors of exposed sealants to match colors of mortar adjoining installed sealant unless otherwise indicated.
 - 3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the No. 100 sieve.
- B. Joint-Sealant Backing:
 - 1. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 2. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended in writing by sealant manufacturer for preventing sealant from adhering to rigid, inflexible, joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- C. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Minimal possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could leave residue on surfaces.
- E. Installation of Joint Sealants:
- F. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- G. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- H. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- I. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- J. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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- K. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- 2.4 Provide concave joint profile to match the original joint tooling on the building.MORTAR MIXES
 - A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
 - B. Do not use admixtures in mortar unless otherwise indicated.
 - C. Mixes: Mix mortar materials in the proportions to match properties of existing mortar to remain, including adhesion, strength and appearance.

PART 3 - EXECUTION

- 3.1 PROTECTION
 - A. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 - 2. Keep wall area wet below pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- 3.2 MASONRY REPOINTING, GENERAL
 - A. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.

3.3 REPOINTING MASONRY

- A. Rake out and repoint joints to the following extent:
 - 1. All joints in areas indicated.
 - 2. Joints indicated as sealant-filled joints.
 - 3. Joints at locations of the following defects:
 - a. Holes and missing mortar.
 - b. Cracks that can be penetrated 1/4 inch (6 mm) or more by a knife blade 0.027 inch (0.7 mm) thick.
 - c. Cracks 1/16 inch (1.6 mm) or more in width and of any depth.
 - d. Hollow-sounding joints when tapped by metal object.
 - e. Eroded surfaces 1/4 inch (6 mm) or more deep.
 - f. Deterioration to point that mortar can be easily removed by hand, without tools.
 - g. Joints filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 - 1. Remove mortar from joints to depth of 3/4 inch, or not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches (50 mm) deep; consult Architect for direction.

SECTION 04 01 20.64 BRICK MASONRY REPOINTING

- 2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
- 3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
 - 1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - 2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
 - 3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 - 4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - 5. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
- F. Pointing with Sealant: Comply with Section 07 92 00 "Joint Sealants." and as follows:
 - 1. After raking out, keep joints dry and free of mortar and debris.
 - 2. Clean and prepare joint surfaces. Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
 - 3. Fill sealant joints with specified joint sealant.
 - a. Install cylindrical sealant backing beneath the sealant. Where space is insufficient for cylindrical sealant backing, install bond-breaker tape.
 - b. Install sealant using only proven installation techniques that ensure that sealant is deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding masonry and matching the contour of adjoining mortar joints.
 - c. Install sealant as recommended in writing by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - 1) Fill joints to a depth equal to joint width, but not more than 1/2 inch (13 mm) deep or less than 1/4 inch (6 mm) deep.
 - d. Tool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant from surfaces adjacent to joint.
 - e. Sanded Joints: Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Lightly retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
 - f. Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.

SECTION 04 01 20.64 BRICK MASONRY REPOINTING

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage qualified testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
- B. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- C. Notify inspectors and Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

END OF SECTION 04 01 20.64

SECTION 04 43 13.16 ADHERED BRICK MASONRY VENEER

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. Brick masonry adhered to wood framing and sheathing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each variety of brick, brick accessory, and manufactured product.
- B. Certification of compliance with Build America, Buy America Act.
- C. Samples for Initial Selection: For colored mortar and other items involving color selection.
- D. Samples for Verification:
 - 1. For each brick type indicated. Include at least two Samples in each set, and show the full range of color and other visual characteristics in completed Work.
 - 2. For each color of mortar required.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced brick masons and brick fitters.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

1.6 FIELD CONDITIONS

- A. Protection of Brick Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed brick masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides, and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining brick masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter, using coverings spread on the ground and over the wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed brick masonry.
- 1.7 COORDINATION
 - A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into brick masonry.

SECTION 04 43 13.16 ADHERED BRICK MASONRY VENEER

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Brick: Obtain each variety of brick, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 OTHER BRICK

- A. Match Architect's samples for color, finish, and other brick characteristics relating to aesthetic effects.
 - 1. Provide product that matches color and texture of existing modular brick.
 - 2. Approved product shall be reviewed based on appearance of size, color and thickness.
 - 3. Provide manufacturer corners.

2.3 MISCELLANEOUS MASONRY ACCESSORIES

- A. Expanded Metal Lath: 3.4 lb./sq. yd. (1.8 kg/sq. m), self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60 (Z180).
- B. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.

2.4 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from brick masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and brick producer.
 - 1. <u>Manufacturers:</u> 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. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
 - b. EaCo Chem, Inc.
 - c. <u>Hydroclean; Hydrochemical Techniques, Inc</u>.
 - d. PROSOCO, Inc.
- 2.5 FABRICATION
 - A. General: Fabricate brick units in sizes and shapes required to comply with requirements indicated.
 - B. Select brick to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Brick Masonry" Article.
 - C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
 - D. Carefully inspect brick at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of brick to remove rust stains and iron particles.
 - E. Gage backs of bricks for adhered veneer if more than 81 sq. in. (522 sq. cm) in area.
 - F. Thickness of Brick: Provide thickness indicated, but not less than the following:
 - 1. Thickness: 1 inch (25 mm) plus or minus 1/4 inch (6 mm).

SECTION 04 43 13.16 ADHERED BRICK MASONRY VENEER

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive brick masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of brick masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean dirty or stained brick surfaces by removing soil, stains, and foreign materials before setting. Clean brick by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING BRICK MASONRY

A. Perform necessary field cutting and trimming as brick is set.

- 1. Use power saws to cut brick that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
- 2. Use hammer and chisel to split brick that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
- B. Sort brick before it is placed in wall to remove brick that does not comply with requirements relating to aesthetic effects, physical properties, fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange bricks in broken-range ashlar pattern with uniform course heights, random lengths, and uniform joint widths.
- D. Arrange bricks in three-course, random-range ashlar pattern with random course heights, random lengths (interrupted coursed), and uniform joint widths.
- E. Arrange bricks with color and size variations uniformly dispersed for an evenly blended appearance.
- F. Set brick to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure brick masonry in place. Set brick accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
- G. Maintain uniform joint widths, except for variations due to different brick sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch (6 mm) at narrowest points or more than 1/2 inch (13 mm) at widest points.
- H. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealing joints are specified in Section 07 92 00 "Joint Sealants."

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.
- D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each brick face from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

SECTION 04 43 13.16 ADHERED BRICK MASONRY VENEER

F. Variation in Plane between Adjacent Bricks: Do not exceed one-half of tolerance specified for thickness of brick.

3.5 INSTALLATION OF ADHERED BRICK MASONRY VENEER

- A. Install lath over building paper or wrap by fastening through sheathing into framing to comply with ASTM C 1063.
- B. Install lath over unit masonry and concrete to comply with ASTM C 1063.
- C. Install scratch coat over metal lath 3/8 inch (10 mm) thick to comply with ASTM C 926.
- D. Coat backs of brick units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar, so a slight excess will be forced out the edges of brick units as they are set. Tap units into place, completely filling space between units and scratch coat.
- E. Rake out joints for pointing with mortar to depth of not less than 1/2 inch (13 mm) before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 ADJUSTING AND CLEANING

- A. Remove and replace brick masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged brick. Brick may be repaired if methods and results are approved by Architect.
 - 2. Defective joints.
 - 3. Brick masonry not matching approved samples and mockups.
 - 4. Brick masonry not complying with other requirements indicated.
- B. Replace in a manner that results in brick masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean brick masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean brick masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning brick masonry.
 - 3. Protect adjacent brick and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 - 5. Clean brick masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
 - 6. Clean brick masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.7 EXCESS MATERIALS AND WASTE

- A. Excess Brick: Stack excess brick where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste including mortar and excess or soilcontaminated sand, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches (100 mm) in greatest dimension.
 - 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 04 43 13.16

SECTION 04 72 00 CAST STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

SUMMARY 1.2

- Section Includes: Α.
 - Cast-stone trim including, but not limited to, the following: 1
 - Chimney cap. a.
- Β. **Related Sections:**
 - Section 04 20 00 "Unit Masonry" for installing cast-stone units in unit masonry. 1

1.3 ACTION SUBMITTALS

- Product Data: For each type of product. Α.
 - For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- Shop Drawings: Show fabrication and installation details for cast-stone units. Include В. dimensions, details of reinforcement and anchorages if any, and indication of finished faces. Include building elevations showing layout of units and locations of joints and anchors.
- 1. C.
 - Samples for Initial Selection: For colored mortar.
 - Sample kit in manufacturer standard sizes for available colors 1.
- Samples for Verification: D.
 - For each color and texture of cast stone required, 10 inches (250 mm) square in size. 1.

1.4 INFORMATIONAL SUBMITTALS

Α. Qualification Data: For manufacturer.

- Include copies of material test reports for completed projects, indicating compliance of 1. cast stone with ASTM C 1364.
- Material Test Reports: For each mix required to produce cast stone, based on testing according Β. to ASTM C 1364, including test for resistance to freezing and thawing.
 - Provide test reports based on testing within previous two years. 1.

1.5 QUALITY ASSURANCE

- Α. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.
 - Manufacturer shall have been in business a minimum of five years. 1.
- В. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.6 DELIVERY, STORAGE, AND HANDLING

- Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to Α. minimize the need for on-site storage.
- Pack, handle, and ship cast-stone units in suitable packs or pallets. Β.
 - Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move 1. cast-stone units if required, using dollies with wood supports.
 - 2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

SECTION 04 72 00 CAST STONE MASONRY

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

2.2 CAST-STONE UNITS

A. Cast-Stone Units: Comply with ASTM C 1364.

- 1. Units shall be manufactured using the vibrant dry tamp or wet-cast method.
- 2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - 3. Provide drips on projecting elements unless otherwise indicated.
- C. Fabrication Tolerances:
 - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
 - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
 - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
 - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.
- D. Cure Units as Follows:
 - 1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
 - 2. Keep units damp and continue curing to comply with one of the following:
 - a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
 - b. No fewer than six days at mean daily temperature of 60 deg F (16 deg C) or above.
 - c. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
 - d. No fewer than eight days at mean daily temperature of 45 deg F (7 deg C) or above.
- E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- F. Colors and Textures: Match Architect's samples as identified in the EXTERIOR FINISH KEY or as selected by Architect from Manufacturer's full range.

2.3 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- B. Dowels: 1/2-inch- (12-mm-) diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

2.4 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

SECTION 04 72 00 CAST STONE MASONRY

2.5 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

END OF SECTION 04 72 00

SECTION 04 72 00 CAST STONE MASONRY

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SECTION 05 50 00 METAL FABRICATIONS

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. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Shelf angles.
 - 3. Structural-steel door frames.
 - 4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:

- 1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- 2. Shelf angles.
- 3. Structural-steel door frames.
- 4. Loose steel lintels.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
- 1.6 FIELD CONDITIONS
 - A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

SECTION 05 50 00 METAL FABRICATIONS

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavyhex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
- F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.3 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

DIVISION 05 - METALS

SECTION 05 50 00 METAL FABRICATIONS

- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normalweight, air-entrained, concrete with a minimum 28-day compressive strength of 4000 psi.

2.4 FABRICATION, GENERAL

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

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
 - 3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

DIVISION 05 - METALS

SECTION 05 50 00 METAL FABRICATIONS

2.6 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize and prime shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-inplace concrete.

2.7 STRUCTURAL-STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.
 - 1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- C. Galvanize and prime exterior steel frames.
- D. Prime exterior steel frames with zinc-rich primer.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with zinc-rich primer.

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 FINISHES, GENERAL

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

SECTION 05 50 00 METAL FABRICATIONS

2.12 STEEL AND IRON FINISHES

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

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
 - A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
 - B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
 - E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
 - F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports securely to, and rigidly brace from, building structure.

DIVISION 05 - METALS

SECTION 05 50 00 METAL FABRICATIONS

- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION 05 50 00

SECTION 06 10 00 **ROUGH CARPENTRY**

PART 1 GENERAL

PART 1		
1.1	REFERENCES	
	The publications listed by publications are referred	below form a part of this specification to the extent referenced. The d to within the text by the basic designation only.
	AMERICAN FOREST F	OUNDATION (AFF)
	ATFS STANDARDS	S American Tree Farm System Standards of Sustainability 2015-2020
	AMERICAN HARDBOA	RD ASSOCIATION (AHA)
	AHA A135.4	Basic Hardboard
	AMERICAN INSTITUTE	E OF TIMBER CONSTRUCTION (AITC)
	AITC 111	Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
	AITC TCM	Timber Construction Manual. 5th Edition
	ANSI/AITC A190.1	American National Standard, Structural Glued Laminated Timber
	AMERICAN LUMBER S	STANDARDS COMMITTEE (ALSC)
	ALSC PS 20	American Softwood Lumber Standard
	AMERICAN RAILWAY	ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)
	AREMA Eng Man	Manual for Railway Engineering
	AMERICAN SOCIETY	OF MECHANICAL ENGINEERS (ASME)
	ASME B18.2.1	Square and Hex Bolts and Screws (Inch Series)
	ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, and Hex, Square,
		Hex Flange, and Coupling Nuts (Inch Series)
	ASME B18.5.2.1M	Metric Round Head Short Square Neck Bolts
	ASME B18.6.1	Wood Screws (Inch Series)
	AMERICAN WOOD CC	DUNCIL (AWC)
	AWC NDS	National Design Specification (NDS) for Wood Construction
	AWC WFCM	Wood Frame Construction Manual for One- and Two-Family Dwellings
	AMERICAN WOOD PR	OTECTION ASSOCIATION (AWPA)
	AWPA BOOK	AWPA Book of Standards
	AWPA M2	Standard for the Inspection of Preservative Treated Wood Products for Industrial Use
	AWPA M6	Brands Used on Preservative Treated Materials
	AWPA P5	Standard for Waterborne Preservatives
	AWPA P18	Nonpressure Preservatives
		Standard for Fire Retardant FR-1
	AWPA U1	Use Category System: User Specification for Treated Wood
	APA - THE ENGINEER	ED WOOD ASSOCIATION (APA)
	APA E30	Engineered Wood Construction Guide
	APA E445	Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
	APA EWS R540	Builder Tips: Proper Storage and Handling of Glulam Beams
	APA EWS T300	Technical Note: Glulam Connection Details

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APA F405 APA L870 APA S350	Product Guide: Performance Rated Panels Voluntary Product Standard, PS 1-09, Structural Plywood PS 2-10, Performance Standard for Wood-Based Structural Use Panels	
AFA 3330	PS 2-10, Performance Standard for Wood-Dased Structural-Ose Parleis	
ASTM INTERNATIONA	L (ASTM)	
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware	
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength	
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Allov-Coated (Galvannealed) by the Hot-Dip Process	
ASTM C208	Standard Specification for Cellulosic Fiber Insulating Board	
ASTM C1136	Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation	
ASTM C1396	Standard Specification for Gypsum Board	
ASTM D198	Standard Test Methods of Static Tests of Lumber in Structural Sizes	
ASTM D696	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer	
ASTM D1435	Standard Practice for Outdoor Weathering of Plastics	
ASTM D1972	Standard Practice for Generic Marking of Plastic Products	
ASTM D2344	Standard Test Method for Short-Beam Strength of Polymer Matrix	
	Composite Materials and Their Laminates	
ASTM D2898	Standard Practice for Accelerated Weathering of Fire-Retardant-Treated	
ASTM D3498	Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Stand Board) to Wood Based Floor System	
	Framing	
ASTM D6108	Standard Test Method for Compressive Properties of Plastic Lumber and Shapes	
ASTM D6109	(2013) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products	
ASTM D6111	Standard Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement	
ASTM D6112	Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes	
ASTM D6117	Standard Test Methods for Mechanical Fasteners in Plastic Lumber and Shapes	
ASTM E96	Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials	
ASTM F547	Standard Terminology of Nails for Use with Wood and Wood-Base Materials	
ASTM F1667	Standard Specification for Driven Fasteners: Nails, Spikes, and Staples	
COMPOSITE PANEL A CPA A208.1	SSOCIATION (CPA) Particleboard	
CSA GROUP (CSA) CSA Z809-08	Sustainable Forest Management	
FM GLOBAL (FM) FM 4435	Roof Perimeter Flashing	
FOREST STEWARDSHIP COUNCIL (FSC)		

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	FSC STD 01 001	Principles and Criteria for Forest Stewardship
GR	EEN SEAL (GS) GS-36	Adhesives for Commercial Use
INT	ERNATIONAL COD	E COUNCIL (ICC) International Building Code
NA	TIONAL HARDWOC NHLA Rules	D LUMBER ASSOCIATION (NHLA) Rules for the Measurement & Inspection of Hardwood & Cypress
NO	RTHEASTERN LUM NELMA Grading Ru	IBER MANUFACTURERS ASSOCIATION (NELMA) Iles Standard Grading Rules for Northeastern Lumber
PR	OGRAMME FOR EN PEFC ST 2002:201	IDORSEMENT OF FOREST CERTIFICATION (PEFC) 3 PEFC International Standard Chain of Custody of Forest Based Products Requirements
RE		ON SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION
	RIS Grade Use	Redwood Lumber Grades and Uses
SO	UTH COAST AIR QU SCAQMD Rule 116	JALITY MANAGEMENT DISTRICT (SCAQMD) 8 Adhesive and Sealant Applications
SO	UTHERN CYPRESS SCMA Spec	MANUFACTURERS ASSOCIATION (SCMA) Standard Specifications for Grades of Southern Cypress
SO	UTHERN PINE INSF SPIB 1003	PECTION BUREAU (SPIB) Standard Grading Rules for Southern Pine Lumber
SU	STAINABLE FORES SFI 2015-2019	T INITIATIVE (SFI) Standards, Rules for Label Use, Procedures and Guidance
TRI	USS PLATE INSTITI TPI 1 TPI HIB	UTE (TPI) National Design Standard for Metal Plate Connected Wood Truss Construction, Including Commentary and Appendices Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses
U.S	5. DEPARTMENT OF DOC/NIST PS56 DOC/NIST PS58	F COMMERCE (DOC) Structural Glued Laminated Timber Basic Hardboard (ANSI A135.4)
U.S	5. GENERAL SERVIO CID A-A-1923 CID A-A-1924 CID A-A-1925 FS UU-B-790	CES ADMINISTRATION (GSA) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors Shield Expansion (Nail Anchors) Building Paper Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)
U.S	. NATIONAL ARCHI	IVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770 Formaldehyde Standards for Composite Wood Products

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UNDERWRITERS LABORATORIES (UL)

UL 2818 GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

WEST COAST LUMBER INSPECTION BUREAU (WCLIB) WCLIB 17 Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA) WWPA G-5 Western Lumber Grading Rules

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES: A. Shop Drawings

- 1. Fabricated Structural Members
 - 2. Modifications of Structural Members
- 3. Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.
- 4. Nailers and Nailing Strips
- 5. Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.
- B. Product Data
 - 1. Salvaged Lumber
 - 2. Recovered Lumber
 - 3. Underlayment
 - 4. Plastic Lumber
 - 5. Fiberboard Wall Sheathing
 - 6. Cellulose Honeycomb Panels
 - 7. Fire-retardant Treatment
 - 8. Structural-use and OSB Panels
 - 9. Oriented Strand Board
 - 10. Adhesives
 - 11. Biobased Content for Strawboard Panels
 - 12. Biobased Content for Cork Underlayment
 - 13. Recycled Content for Plastic Lumber
 - 14. Recycled Content for Fiberboard Underlayment
 - 15. Recycled Content for Cork Underlayment
 - 16. Recycled Content for Fiberboard Wall Sheathing
 - 17. Recycled Content for Cellulose Honeycomb Panels
- C. Design Data
 - 1. Modifications of Structural Members
 - 2. Design analysis and calculations showing design criteria used to accomplish the applicable analysis.
- D. Test Reports
 - 1. Preservative-treated Lumber and Plywood
- E. Certificates
 - 1. Certificates of Grade
 - 2. Certified Sustainably Harvested Virgin Lumber
 - 3. Certified Sustainably Harvested Natural-decay and Insect-resistant Wood
 - 4. Certified Sustainably Harvested Framing Lumber
 - 5. Certified Sustainably Harvested Structural Glued Laminated Timber
 - 6. Certified Sustainably Harvested Plywood Subflooring

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- 7. Certified Sustainably Harvested Structural-use and OSB Panel Subfloor Sheathing
- 8. Certified Sustainably Harvested Plywood Combination Subfloor Underlayment
- 9. Certified Sustainably Harvested Plywood Wall Sheathing
- 10. Certified Sustainably Harvested Structural-use and OSB Panel Wall Sheathing
- 11. Certified Sustainably Harvested Plywood Roof Sheathing
- 12. Certified Sustainably Harvested Plywood Diaphragm
- 13. Certified Sustainably Harvested Structural-use and OSB Panel Diaphragm
- 14. Certified Sustainably Harvested Plywood Shear Wall
- 15. Certified Sustainably Harvested Structural-use and OSB Panel Shear Wall
- 16. Certified Sustainably Harvested Plywood for Other Uses
- 17. Certified Sustainably Harvested Structural-use and OSB Panels for Other Uses
- 18. Certified Sustainably Harvested Plywood Underlayment
- 19. Preservative Treatment
- 20. Indoor Air Quality for Particleboard Underlayment
- 21. Indoor Air Quality for Fiberboard Underlayment
- 22. Indoor Air Quality for Strawboard Panels
- 23. Indoor Air Quality for Fiberboard Wall Sheathing
- 24. Indoor Air Quality for Aerosol Adhesives
- 25. Indoor Air Quality for Non-aerosol Adhesives
- F. Operation and Maintenance Data
 - 1. Plastic
 - 2. When not labeled, identify types in Operation and Maintenance Manual.
 - 3. Take-back Program
 - 4. Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling or reuse.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well-ventilated enclosure. Store wood I-beams and glue-laminated beams and joists on edge. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. Handle and store laminated timber in accordance with AITC 111 or APA EWS R540. Do not use materials that have visible moisture or biological growth. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

A. Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency must be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view must not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

B. Structural Glued Laminated Timber

Mark each member with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of structural glued laminated timber products. The marking must indicate compliance with ANSI/AITC A190.1 and must include all identification information required by ANSI/AITC A190.1. Structurally end-jointed lumber must also be certified and grade marked in accordance with ANSI/AITC A190.1.

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C. Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark must identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870. Surfaces that are to be exposed to view must not bear grademarks or other types of identifying marks.

- D. Structural-Use and OSB Panels Mark each panel with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the panel. The mark must indicate end use, span rating, and exposure durability classification. Oriented Strand Board (OSB), APA F405.
- E. Preservative-Treated Lumber and Plywood

The Contractor is responsible for the quality of treated wood products. Each treated piece must be inspected in accordance with AWPA M2 and permanently marked or branded, by the producer, in accordance with AWPA M6. The Contractor must provide Contracting Officer's Representative (COR) with the inspection report of an approved independent inspection agency that offered products comply with applicable AWPA Standards. The appropriate Quality Mark on each piece will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

F. Fire-Retardant Treated Lumber

Mark each piece in accordance with AWPA M6, except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber must be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of AWPA M6.

G. Hardboard, Gypsum Board, and Fiberboard Mark each sheet or bundle to identify the standard under which the material is produced and the producer.

H. Plastic Lumber

Label plastic products to be incorporated into the project in accordance with ASTM D1972 or provide product data indicating polymeric information in the Operation and Maintenance Manual.

- a. Type 1: Polyethylene Terephthalate (PET, PETE).
- b. Type 2: High Density Polyethylene (HDPE).
- c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
- d. Type 4: Low Density Polyethylene (LDPE).
- e. Type 5: Polypropylene (PP).
- f. Type 6: Polystyrene (PS).
- g. Type 7: Other. Use of this code indicates that the package in question. is made with a resin other than the six listed above or is made of more than one resin listed above and used in a multi-layer combination.

1.5 SIZES AND SURFACING

ALSC PS 20 for dressed sizes of yard and structural lumber. Lumber must be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes must be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products must be as follows at the time of delivery to the job site:

- A. Framing lumber and board, 19 percent maximum
- B. Timbers 5 inches and thicker, 25 percent maximum
- C. Roof planking, 15 percent maximum

SECTION 06 10 00 ROUGH CARPENTRY

D. Materials other than lumber; moisture content must be in accordance with standard under which the product is produced

1.7 PRESERVATIVE TREATMENT

Treat wood products with waterborne wood preservatives conforming to AWPA P5. Pressure treatment of wood products must conform to the requirements of AWPA BOOK Use Category System Standards U1 and T1. Pressure-treated wood products must not contain arsenic, chromium, or other agents classified as carcinogenic, probably carcinogenic, or possibly carcinogenic to humans (compounds in Groups 1, 2A, or 2B) by the International Agency for Research on Cancer (IARC), Lyon, France. Pressure-treated wood products must not exceed the limits of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP) and must not be classified as hazardous waste. Submit certification from treating plant stating chemicals and process used and net amount of preservatives retained are in conformance with specified standards. In accordance with AWPA U1 provide non-copper preservative treatment such as EL2, PTI or SBX, DOT for products in direct contact with sheet metal.

- A. 0.25 pcf intended for above ground use.
- B. 0.40 pcf intended for ground contact and freshwater use. 0.60 pcf intended for Ammoniacal Copper Quaternary Compound (ACQ)-treated foundations. 0.80 to 1.00 pcf intended for ACQ-treated pilings. All wood must be air or kiln dried after treatment. Specific treatments must be verified by the report of an approved independent inspection agency, or the AWPA Quality Mark on each piece. Do not incise surfaces of lumber that will be exposed. Minimize cutting and avoid breathing sawdust. Brush coat areas that are cut or drilled after treatment with either the same preservative used in the treatment or with a 2 percent copper naphthenate solution. All lumber and woodwork must be preservative treated. Plastic lumber must not be preservative treated. The following items must be preservative treated:
 - 1. Wood framing, woodwork, and plywood up to and including the subflooring at the firstfloor level of structures having crawl spaces when the bottoms of such items are 24 inches or less from the earth underneath.
 - 2. Wood members that are in contact with water.
 - 3. Exterior wood steps, platforms, and railings; and all wood framing of open, roofed structures.
 - 4. Wood sills, soles, plates, furring, and sleepers that are less than 24 inches from the ground, furring and nailers that are set into or in contact with concrete or masonry.
 - 5. Nailers, edge strips, crickets, curbs, and cants for roof decks.
- C. Existing Structures

Use borate, permathrin, or a sodium silicate wood mineralization process to treat wood. Use borate for interior applications only.

D. New Construction Use a boron-based preservative conforming to AWPA P18, sodium silicate wood mineralization process, or Ammoniacal Copper Quaternary Compound to treat wood. Use boron-based preservatives for above-ground applications only.

1.8 FIRE-RETARDANT TREATMENT

Fire-retardant treated wood must be pressure treated with fire retardants conforming to AWPA P49. Fire retardant treatment of wood products must conform to the requirements of AWPA U1, Commodity Specification H and AWPA T1, Section H. Treatment and performance inspection must be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting must be subjected to an accelerated weathering technique in accordance with ASTM D2898 prior to being tested. Such items which will not be inside a building, and such items which will be exposed to heat or high humidity, must receive exterior fire-retardant treatment. Fire-retardant-treated wood products must be free of halogens, sulfates, ammonium phosphate, and formaldehyde.

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1.9 QUALITY ASSURANCE

A. Drawing Requirements

For fabricated structural members, trusses, qlu-lam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

- B. Data Required Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.
- C. Humidity Requirements Sequence work to minimize use of temporary HVAC to dry out building and control humidity.
- D. Plastic Lumber Performance Plastic lumber intended for use in exterior applications must have no fading or discoloration and no change in dimensional stability as tested in accordance with ASTM D1435 for a period of 5 years.

1.10 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

1.11 CERTIFICATIONS

A. Certified Wood Grades

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

B. Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by FSC STD 01 001. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third-party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line-item basis. Submit copies of invoices bearing certification numbers.

C. Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1. Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

Composite Wood, Wood Structural Panel and Agrifiber Products
 For purposes of this specification, composite wood and agrifiber products include
 particleboard, medium density fiberboard (MDF), strawboard, panel substrates, and door
 cores. Provide products certified to meet requirements of both 40 CFR 770 and CARB
 93120. Provide current product certification documentation from certification body.

PART 2 PRODUCTS

2.1 MATERIALS

A. Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible. Provide certified sustainably harvested virgin lumber.

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B. Salvaged Lumber

Provide salvaged lumber where specified. Unless otherwise noted, salvaged lumber must be delivered clean, denailed, and free of paint, finish materials, and other contamination. Lumber must meet the other criteria within this section. Provide documentation certifying products are from salvaged lumber sources.

C. Recovered Lumber

Use recovered lumber where practical. Unless otherwise noted, recovered lumber must be delivered clean and free of contamination. Provide grading certificates for any recovered wood materials used in structural applications. Lumber must meet the other criteria within this section. Provide documentation certifying products are from recovered lumber sources.

D. Natural Decay- and Insect-Resistant Wood

Naturally durable wood must be certified sustainably harvested natural-decay and insectresistant wood. An occasional piece with corner sapwood is permitted if 90 percent or more of the width of each side on which the sapwood occurs is heartwood. The primary species to use on this project is redwood.

E. Plastic Lumber

HDPE lumber must contain a minimum of 90 percent total recycled content. Mixed plastics and cellulose lumber must contain a minimum of 100 percent total recovered materials content, with a minimum of 50 percent post-consumer recycled content. HDPE/fiberglass lumber must contain a minimum of 95 percent total recovered materials content with a minimum of 75 percent post-consumer recycled content. Other mixed resin lumber must contain a minimum of 95 percent total recovered materials content with a minimum of 95 percent total recovered materials content with a finimum of 95 percent total recovered materials content with a minimum of 50 percent total recovered materials content with a minimum of 50 percent total recovered materials content with a minimum of 50 percent post-consumer recycled content. Provide data identifying percentage of recycled content for plastic lumber.

- Shear Parallel to Length Maximum 1,000 psi in accordance with ASTM D2344/D2344M.
- 2. Density
- ASTM D6111.
- 3. Compressive Strength
 - a. Secant Modulus: Minimum 70,000 psi in accordance with ASTM D6108.
 - b. Stress at 3 percent strain: Minimum 1,500 psi in accordance with ASTM D6108.
 - c. Compression Parallel to Grain: Minimum 3,000 psi in accordance with ASTM D6112.
 - d. Compression Perpendicular to Grain: Minimum 1,000 psi in accordance with ASTM D6112.
- 4. Flexural Strength

Minimum 2,000 psi in accordance with ASTM D6109.

- 5. Tensile Strength Minimum 1 250 psi in accordance with ASTM D
- Minimum 1,250 psi in accordance with ASTM D198.
- Coefficient of Thermal Expansion Maximum 0.000080 in/in/degree F in accordance with ASTM D696.
- Screw Withdrawal 350 lbs in accordance with ASTM D6117.
- Nail Withdrawal 150 lbs in accordance with ASTM D6117.

2.2 LUMBER

A. Structural Lumber

Any of the species and grades listed in AWC NDS that have allowable unit stresses in pounds per square inch (psi) not less than allowable unit stresses indicated. Use for joists, rafters, headers, trusses, beams (except collar beams), columns, posts, stair stringers, girders, and all other members indicated to be stress rated.

Structural lumber exposed to view must be appearance grade of any species meeting the allowable unit stresses specified. Design of members and fastenings must conform to AITC

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TCM. Other stress graded or dimensioned items such as blocking, carriages, and studs must be standard or No. 2 grade except that studs may be Stud grade.

B. Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, can't strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing must be one of the species listed in the table below. Minimum grade of species must be as listed. Provide certified sustainably harvested framing lumber.

C. Structural Glued Laminated Timber

ANSI/AITC A190.1, allowable working stress values for loads of normal duration in pounds per square inch (psi) not less than the following:

Bending Members,	Fb,	Fv,	E.
Compression Members, [] Fc, []E.	-
Tension Members, [_] Ft, [_] E.	

Fabricated with wet-use adhesives. Beams must use glue-laminated and laminated-veneer lumber. Posts and studs must use laminated-strand lumber. Joists must use laminated-veneer lumber. Members must be Architectural Appearance Grade, sealed with a penetrating sealer, and bundle wrapped as standard with the manufacturer and approved. Members must be complete with hardware for joining laminated members and for their connection to other construction. Provide certified sustainably harvested structural glued laminated timber. When located on the interior of buildings, provide products with no added urea-formaldehyde resins.

2.3 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS APA L870, APA S350, APA E445, and APA F405 respectively.

- A. Subflooring
 - 1. Plywood

C-D Grade, Exposure 1 durability classification, Span rating of 24/16 or greater. Provide certified sustainably harvested plywood subflooring.

- Structural-Use and OSB Panels Sheathing grade with durability equivalent to Exposure 1, Span Rating of 48/24 or greater. OSB, APA E445, Rated Sturd-I-Floor. Provide certified sustainably harvested structural-use and OSB panel subfloor sheathing.
- B. Combination Subfloor-Underlayment
 - 1. Plywood

Exterior Type, C-C (Plugged) Grade. Provide certified sustainably harvested plywood combination subfloor underlayment. Minimum thickness must be as listed below except where indicated to have greater thickness.

Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce- Lodgepole Pine, Engelmann Spruce, Hem- Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine- Lodgepole Pine, Subalpine Fir, White Woods, Western	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common

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Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
	Woods, Western Cedars, Western Hemlock		
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem- Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2. Structural-Use Panel

Combination subfloor-underlayment grade with durability equivalent to Exterior plywood, Span Rating of 24 or greater.

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- C. Wall Sheathing
 - 1. Plywood

C-D Grade, Exposure 1, and a minimum thickness of 1/2 inch, except where indicated to have greater thickness. Provide certified sustainably harvested plywood wall sheathing. Provide exterior grade material with phenol resin for interior and exterior applications.

 Structural-Use and OSB Panels Sheathing grade with durability equivalent to Exposure 1, Span Rating of 24/0 or greater. OSB, APA Rated Sheathing. OSB must be a phenolic-glued board. Provide certified sustainably harvested structural-use and OSB panel wall sheathing.

D. Other Uses

- 1. Plywood
 - C-D Grade, Exposure 1. Provide certified sustainably harvested plywood for other uses.
- Structural-Use and OSB Panels Sheathing grade with durability equivalent to Exposure 1 and a minimum thickness of 1/2 inch. Provide certified sustainably harvested structural-use and OSB panels for other uses.

2.4 UNDERLAYMENT

Underlayment must conform to one of the following:

- A. Hardboard
 - AHA A135.4 service class, sanded one side, 1/4 inch thick, 4 feet wide.
- B. Particleboard

CPA A208.1, Grade 1-M-1, 1/4 inch thick, 4 by 4 feet. Compressed fibers with polymeric methylene diisocyanate (PMDI) resin binder. Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for particleboard underlayment.

C. Plywood

Plywood must conform to APA L870, underlayment grade with exterior glue, or C-C (Plugged) exterior grade 11/32 inch thick, 4 feet wide. Provide certified sustainably harvested plywood underlayment.

D. Oriented Strand Board

OSB underlayment grade 0.225 inch.

E. Fiberboard

Use structural fiberboard, minimum 80 percent recycled newspaper. Provide data identifying percentage of recycled content for fiberboard underlayment. Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for fiberboard underlayment.

F. Strawboard Panels

Minimum 70 percent agricultural waste straw with no added formaldehyde binders. Submit data identifying percentage of biobased content for strawboard panels. Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for strawboard panels.

G. Cork

Minimum 85 percent total recycled content. Provide data identifying percentage of recycled content for cork underlayment. Minimum 85 percent biobased content. Provide data identifying percentage of biobased content for cork underlayment.

2.5 OTHER MATERIALS

A. Hardboard Underlayment

DOC/NIST PS58, service class, sanded on one side, 1/4 inch thick 4 feet wide.

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B. Fiberboard Wall Sheathing

ASTM C208, 2 feet wide by 1/2 inch thick for supports 16 inches (o.c.) or 4 feet wide by 3/4 inch thick for supports 24 inches o.c., except only 4 feet wide by 1/2-inch-thick sheathing over supports at 16 inches o.c. may be applied without corner bracing of framing. Sheathing must be asphalt impregnated or asphalt coated to render the sheathing water resistant but vapor permeable. Structural fiberboard must contain a minimum of 80 percent recycled content. Non-structural fiberboard must contain a minimum of 100 percent post-consumer recycled content. Provide data identifying percentage of recycled content for fiberboard wall sheathing. Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for fiberboard wall sheathing.

C. Gypsum Wall Sheathing

ASTM C1396/C1396M, 1/2-inch-thick fire retardant (Type X) 5/8 inch thick; 4 feet wide with square edge for supports 16 inches o.c. with or without corner bracing of framing or for supports 24 inches o.c. with corner bracing of framing; 2 feet wide with V-tongue and groove (T&G) edge for supports 16 inches o.c. with corner bracing of framing.

- D. Miscellaneous Wood Members
 - 1. Nonstress Graded Members

Members must include bridging, corner bracing, furring, grounds, and nailing strips. Members must be in accordance with TABLE I for the species used. Sizes must be as follows unless otherwise shown:

Support Spacing	Underlayment Minimum Thickness
16 inches	1/2 inch for Group 1 species
	19/32 inch for Group 2 and 3 species 23/32 inch for Group 4 species
24 inches	23/32 inch for Group 1 species
	7/8 inch for Group 2 and 3 species
	1 inch for Group 4 species

2. Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

3. Sill Plates

Sill plates must be standard or number 2 grade.

4. Blocking

Blocking must be standard or number 2 grade.

- 5. Rough Bucks and Frames Rough bucks and frames must be straight standard or number 2 grade.
- E. Adhesives

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for non-aerosol adhesives applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of indoor air quality for aerosol adhesives used on the interior of the building (inside of the weatherproofing system).

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2.6 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware must be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials must be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs must be hot-dip zinc-coated in accordance with ASTM A153/A153M. Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather must be copper alloy or hot-dipped galvanized fasteners as recommended by the treated wood manufacturer.

- A. Bolts, Nuts, Studs, and Rivets ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.
- B. Anchor Bolts ASTM A307, size as indicated, complete with nuts and washers.
- C. Expansion Shields CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices must be 3/8 inch.
- D. Lag Screws and Lag Bolts ASME B18.2.1.
- E. Wood Screws
- ASME B18.6.1.
- F. Nails and Staples

ASTM F547, size and type best suited for purpose; staples must be as recommended by the manufacturer of the materials to be joined. For sheathing and subflooring, length of nails must be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails must be used for nailing through 1-inch-thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails must be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing must be hot-dipped galvanized in accordance with ASTM A153/A153M. Nailing must be in accordance with the recommended nailing schedule contained in AWC WFCM. Where detailed nailing requirements are not specified, nail size and spacing must be sufficient to develop an adequate strength for the connection. The connection's strength must be verified against the nail capacity tables in AWC NDS. Reasonable judgment backed by experience must ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector must be used.

G. Wire Nails

I.

ASTM F1667/F1667M.

- H. Timber Connectors Unless otherwise specified, timber connectors must be in accordance with TPI 1, APA
 - EWS T300 or AITC TCM. Clip Angles

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

J. Joist Hangers

Steel or iron, zinc coated, sized to fit the supported member, of sufficient strength to develop the full strength of the supported member in accordance with ICC IBC, and furnished complete with any special nails required.

K. Tie Straps

For joists supported by the lower flange of steel beams, provide 1/8 by 1-1/2 inch steel strap, 2 feet long, except as indicated otherwise.

L. Joist Anchors

For joists supported by masonry walls, provide anchors 3/16 by 1 1/2-inch steel tee or strap, bent and of length to provide 4 inches embedment into wall and 12 inches along joist except as indicated otherwise. For joists parallel to masonry or concrete walls,
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provide anchors 1/4 by 1-1/4-inch minimum cross-sectional area, steel strap, length as necessary to extend over top of first three joists and into wall 4 inches, and with wall end of bend or pin type, except as indicated otherwise.

M. Door Buck Anchors

Metal anchors, 1/8 by 1-1/4-inch steel, 12 inches long, with ends bent 2 inches, except as indicated otherwise. Anchors must be screwed to the backs of bucks and built into masonry or concrete. Locate 8 inches above sills and below heads and not more than 24 inches intermediately between. Anchorage of bucks to steel framing must be as necessary to suit the conditions.

N. Metal Bridging

Where not indicated or specified otherwise, No. 16 U.S. Standard gage, cadmium-plated or zinc-coated.

- O. Toothed Rings and Shear Plates AWC NDS.
- P. Beam Anchors Steel U-shaped strap anchors 1/4 inch thick by 1-1/2 inches wide, except as indicated otherwise.
- Q. Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A653/A653M, G90. Except where otherwise shown, Steel must be not lighter than 18 gage. Special nails supplied by the manufacturer must be used for all nailing.

R. Panel Edge Clips Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

2.7 AIR INFILTRATION BARRIER

Air infiltration barrier must be building paper meeting the requirements of ASTM C1136, Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of 125g per square meter per 24 hours in accordance with ASTM E96/E96M, Desiccant Method at 23 degrees C or with a moisture vapor transmission rate of 670g per square meter per 24 hours in accordance with ASTM E96/E96M, Water Method at 23 degrees C.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth. Conform to AWC WFCM and install in accordance with the National Association of Home Builders (NAHB) Advanced Framing Techniques: Optimum Value Engineering, unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Space plastic lumber boards as necessary to allow for lengthwise expansion and contraction. Do not splice framing members between bearing points. Set joists, rafters, and purlins with their crown edge up. Frame members for the passage of pipes, conduits, and ducts. Provide adequate support as appropriate to the application, climate, and modulus of elasticity of the product. Do not cut or bore structural members for the passage of ducts or pipes without approval. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise must be in accordance with the Nailing Schedule contained in ICC IBC; perform bolting in an approved manner. Spikes, nails, and bolts must be drawn up tight. Install plastic lumber with screws or bolts; if nails are used, use ring shank or spiral shank nails. Timber connections and fastenings must conform to AWC NDS. Provide 2 inch minimum clearance between chimneys and wood framing; provide 4 inch minimum clearance at fireplaces. Fill the spaces with strips of approved noncombustible material. Use slate

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or steel shims when leveling joists, beams, and girders on masonry or concrete. Do not use shimming on wood or metal bearings. When joists, beams, and girders are placed on masonry or concrete, a wood base plate must be positioned and leveled with grout. The joist, beam, or girder must then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket must be formed into the wall. The joist, beam, or girder must then be placed into the pocket and leveled with a steel shim.

A. Sills

Set sills level and square and wedge with steel or slate shims; point or grout with nonshrinking cement mortar to provide continuous and solid bearing. Anchor sills to the foundations as indicated. Where sizes and spacing of anchor bolts are not indicated, provide not less than 5/8 inch diameter bolts at all corners and splices and space at a maximum of 6 feet o.c. between corner bolts. Provide at least two bolts for each sill member. Lap and splice sills at corners and bolt through the laps or butt the ends and through-bolt not more than 6 inches from the ends. Provide bolts with plate washers and nuts. Bolts in exterior walls must be zinc-coated.

1. Anchors in Masonry

Embed anchor bolts not less than 15 inches in masonry unit walls and provide each with a nut and a 2 inch diameter washer at bottom end. Fully grout bolts with mortar.

2. Anchors in Concrete

Embed anchor bolts not less than 8 inches in poured concrete walls and provide each with a nut and a 2 inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend must be not less than 90 degrees. Powder-actuated fasteners spaced 3 feet o.c. may be provided in lieu of bolts for single thickness plates on concrete.

B. Beams and Girders

Set beams and girders level and in alignment and anchor to bearing walls, piers, or supports with U-shaped steel strap anchors. Embed anchors in concrete or masonry at each bearing and through-bolt to the beams or girders with not less than two bolts. Provide bolts not less than 1/2 inch in diameter and with plate washers under heads and nuts. Install beams and girders with 8-inch minimum end bearing on walls or supports. Install beams and girders into walls with 1/2-inch clearance at the top, end, and sides or standard steel wall-bearing boxes. Provide joints and splices over bearings only and bolt or spike together.

C. Roof Framing or Rafters

Tops of supports or rafters must form a true plane. Valley, ridge, and hip members must be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters and nominally 2 inches thick. Rafters must have full and solid bearing on plates. Valleys, hips, and ridges must be straight and true intersections of roof planes. Necessary crickets and watersheds must be formed. Rafters, except hip and valley rafters, must be bolted by angles. Rafters must be toe-nailed to ridge, valley, or hip members with at least three 8-penny nails. Rafters must be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters must be secured to wall plates by clip angles. Openings in roof must be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter must be double. Hip rafters longer than the available lumber must be butt jointed and scabbed. Valley rafters longer than the available lumber must be double, with pieces lapped not less than 4 feet and well spiked together. Install trussed rafters in accordance with TPI HIB. Install engineered wood joists in accordance with distributor's instructions.

D. Joists

Provide joists of the sizes and spacing indicated, accurately and in alignment, and of uniform width. Joists must have full bearing on sills, plates, beams, girders, and trusses; provide laps over bearing only and spike. Where joists are of insufficient length to produce a 12 inch lap, butt joists over bearing and provide wood scabs 2 nominal inches thick by depth of joists by 24 inches long or metal straps 1/4 by 1 1/2 inch by not less than 18 inches long nailed to each joist with not less than four 10-penny nails, or approved sheet metal connectors installed in accordance with the manufacturer's recommendations. Provide joists built into

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masonry with standard steel wall bearing boxes. Provide metal hangers for joists framing into the side of headers, beams, or girders. When a portion of the joist extends above the top flange of a steel beam or girder, provide a 3/8 inch space between the top flange and the extended portion of the joists to allow for shrinkage of joists. The minimum joist end bearing must be 4 inches, and joists built into concrete or masonry must have a 1/2 inch minimum clearance at the top, end, and sides. For joists approved to be bored for the passage of pipes or conduits, bore through the neutral axis of the joist. Provide steel joist hangers of proper size and type to receive the ends of all framed joists.

1. Floor (Ceiling) Framing

Except where otherwise indicated joists must have bearings not less than 4 inches on concrete or masonry and 1-1/2 inches on wood or metal. Joists, trimmers, headers, and beams framing into carrying members at the same relative levels must be carried on joist hangers. Joists must be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors must be framed with headers and trimmers. Headers carrying more than two tail joists and trimmers supporting headers carrying more than one tail joist must be doubled, unless otherwise indicated. Joists built into masonry must be provided with standard steel wall bearing boxes. Install engineered wood joists in accordance with distributor's instructions.

2. Doubled Joists

Provide under bearing walls and partitions running parallel with the floor joists, around stairways, chimneys, fireplaces, and at other openings where joists are cut and framed. Double, space for clearance, block apart 4 feet on center, rigidly frame, and spike together joists under partitions that are to receive ducts, pipes, and conduits.

3. Tie Straps

For joists supported by the lower flange of steel beams, provide straps at every fourth joist and the corresponding fourth joist on the opposite side. Tie joists across the top of the steel beam with a steel strap. Form straps to lie flat across the top of the beam and twist at the ends to provide flat contact with the side of each joist. Nail each strap at each end with three 10-penny nails spaced 2 inches o.c.

4. Joist Anchors

Provide anchors for each fourth joist supported by a masonry wall. Build wall end of anchors into the wall. Nail anchor to the joist with three 10-penny nails spaced 2 inches o.c. Anchor the first three joists parallel to concrete or masonry walls at bridging points, but not less than 8 feet o.c. from end walls. Let anchors into the tops of each joist and spike to the top of joist with one 10-penny nail. Extend anchors at least 4 inches into the wall.

E. Bridging

Provide bridging for floor and ceiling joists and for roof rafters having slopes of less than 1/3. Locate bridging as indicated and as specified herein. Provide bridging for spans greater than 6 feet, but do not exceed 8 feet maximum spacing between rows of bridging. Install rows of bridging uniformly. Provide metal or wood cross-bridging, except where solid bridging is indicated. Do not nail the bottom end of cross-bridging until the subfloor has been laid.

1. Wood Cross-Bridging

Provide wood cross-bridging not less than 2 by 4 nominal size. Nail wood cross-bridging at each end with three 8-penny nails for 2 by thick material.

2. Metal Cross-Bridging

Must be the manufacturer's standard product, not less than 16 gage before forming and coating. Metal bridging must be the compression type, lodged into or nailed to the wide faces of opposite joists at points diagonally across from each other near the bottoms and tops of joists.

- F. Subflooring
 - 1. Plywood, Structural-Use, and OSB Panels

Apply best side up with the grain of outer plies or the long dimension at right angles to joists. Stagger end joints and locate over the centerline of joists. Support panel edges by

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nominal 2 by 4 members framed between joists so the edge joints of subfloor occur over the centerline of blocking. Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Panels must be continuous over two or more spans. Nail panels 6 inches o.c. at supported edges and 10 inches o.c. over intermediate bearing. Nails must be 8-penny common or 6-penny threaded. Provide at least 1/2 inch clearance between subflooring and masonry or concrete walls. Subflooring may be installed with adhesive conforming to ASTM D3498 and nails spaced at 12 inches on center unless otherwise shown.

2. Combination Subfloor-Underlayment

Apply with the grain of the face plies or the long dimension at right angles to joists. Panels ust be continuous over two or more spans. Stagger end joints of adjacent panels. Panel edges must be T&G or supported by 2 by 4 members framed between joists so the edge joints of subfloor-underlayment occur over the centerline of blocking. Provide end joints of panels over the centerline of joists. Allow 1/8 inch spacing between panel edge and end joints. Nail panels 6 inches o.c. at ends and edges and 10 inches o.c. along intermediate bearings unless they are glue-nailed in accordance with APA E30. Nails must be 8-penny coated common or 6-penny threaded. Provide at least 1/2 inch clearance between subfloor-underlayment and masonry or concrete walls. Lightly sand all joints to receive resilient flooring.

3. Wood

Subflooring must be applied diagonally with end joints made over supports. Each board must bear on at least three supports and must be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width.

4. Depressed Subfloors

Provide depressed subfloors to receive ceramic and quarry tile floors. Nail cleats or ledgers of one by four material to the sides of joists to support the flooring material. Place the cleats at a depth below the top of the joists sufficient to allow the installation of the subflooring below the tops of joists. Snugly fit subflooring as specified herein between joists.

G. Underlayment

Install underlayment over subfloor just prior to laying of resilient flooring and protect from water and physical damage. Stagger end joints of underlayment with respect to each other and stagger all joints with respect to paralleling panel joints in subfloor. Space panels 1/16 inch apart at ends and 1/8 inch apart at edges and at least 1/2 inch from concrete or masonry walls. Nail panels 6 inches o.c. along edges and 6 inches o.c. each way throughout panel, but not closer than 3/8 inch to panel edges. Nails must be 4-penny annular ring or screw type and must be countersunk 1/16 inch. Lightly sand all joints to receive resilient flooring.

H. Columns and Posts

Set columns and posts, plumb, in alignment, and with full and uniform bearing. Do not embed the bottom and bearing surfaces of posts in concrete or set in direct contact with concrete slabs on grade. Provide post and beam construction with steel post caps in such a manner that the post above will tier directly over the one below; fabricate the assembly in a rigid and substantial manner using bolts or lag screws.

- I. Wall Framing
 - 1. Studs

Select studs for straightness and set plumb, true, and in alignment. In walls and partitions more than 8 feet tall, provide horizontal bridging at not more than 8 feet o.c. using nominal 2-inch material of the same width as the studs; install the bridging flat. Sizes and spacing of studs must be as indicated. Double studs at jambs and heads of openings and triple at corners to form corner posts. Frame corner posts to receive sheathing, lath, and interior finish. Truss over openings exceeding 4 feet in width or use a header of sufficient depth. Toe-nail studs to sills or sole plates with four 8-penny nails or fasten with metal nailing clips or connectors. Anchor studs abutting concrete or masonry

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walls thereto near the top and bottom and at midheight of each story using expansion bolts or powder-actuated drive studs.

2. Plates

Use plates for walls and partitions of the same width as the studs to form continuous horizontal ties. Splice single plates; stagger the ends of double plates. Double top plates in walls and bearing partitions, built up of two nominal 2 inch thick members. Top plates for nonbearing partitions must be single or double plates of the same size as the studs. Nail lower members of double top plates and single top plates to each stud and corner post with two 16-penny nails. Nail the upper members of double plates to the lower members with 10-penny nails, two near each end, and stagger 16 inches o.c. intermediately between. Nail sole plates on wood construction through the subfloor to each joist and header; stagger nails. Anchor sole plates on concrete with expansion bolts, one near each end and at not more than 6 feet o.c., or with powder-actuated fasteners, one near each end and at not more than 3 feet o.c. Provide plates cut for the passage of pipes or ducts with a steel angle as a tie for the plate and bearing for joist.

3. Firestops

Provide firestops for wood framed walls and partitions and for furred spaces of concrete or masonry walls at each floor level and at the ceiling line in the top story. Where firestops are not automatically provided by the framing system used, they must be formed of closely fitted wood blocks of nominal 2 inch thick material of the same width as the studs and joists. Lightweight concrete units may be used at the first-floor level to serve jointly as firestopping and ratproofing.

4. Diagonal Bracing

Provide diagonal bracing at all external corners and internal angles and at maximum 40 foot centers in stud walls, except that bracing may be omitted where diagonally applied wood sheathing, plywood or structural-use panel sheathing, 4 by 8 foot fiberboard sheathing, or gypsum board sheathing is used. Bracing must be of 1 by 6 material, let into the exterior face of studs. Extend bracing from top plates to sill at an angle of approximately 45 degrees and double nail at each stud. When openings occur near corners, provide diagonal knee braces extending from the corner post above headers to top plates and from below window sills to the main sill. Nail bracing at each bearing with two 8-penny nails.

- J. Wall Sheathing
 - 1. Plywood, Structural-Use, and OSB Panel Wall Sheathing

Apply horizontally or vertically. Extend sheathing over and nail to sill and top plate. Abut sheathing edges over centerlines of supports. Allow 1/8 inch spacing between panels and 1/8 inch at windows and doors. If sheathing is applied horizontally, stagger vertical end joints. Nail panels with 6-penny nails spaced 6 inches o.c. along edges of the panel and 12 inches o.c. over intermediate supports. Keep nails 3/8 inches away from panel ledges. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

- 2. Fiberboard Wall Sheathing Apply fiberboard wall sheathing allowing a 1/8 inch joint at edges to permit expansion, except at frames and openings where sheathing must be fitted snugly. Pre-expand sheathing before application, allowing sheathing to condition for humidity as recommended by the sheathing manufacturer. Provide 2 by 4 blocking for horizontal edges not otherwise supported.
 - a. Fiberboard wall sheathing used with diagonal-braced framing must be either 2 or 4 feet wide. Sheathing 2 feet wide must have T&G or shiplapped edges and must be applied horizontally with vertical joints staggered. Apply sheathing with tongued edge up and nail at edges and intermediate bearings with 1-3/4 inch long, zinc-coated steel roofing nails spaced on maximum 4-1/2 inch centers. Apply sheathing 4 feet wide either horizontally or vertically. Nail sheathing with 1-3/4 inch long, zinc-coated steel roofing nails spaced 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.

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- b. Fiberboard wall sheathing used with unbraced framing must be 4 feet wide. Apply sheathing vertically. Extend sheathing over and nail to sill and top plates. Locate joints over centerlines of supports. Nail sheathing with 1-1/2 inch long, zinc-coated steel roofing nails with 3/8 inch diameter heads. Space nails 3 inches o.c. at edges and ends and 6 inches o.c. at intermediate bearings.
- 3. Gypsum Sheathing Board

Apply gypsum sheathing board either horizontally or vertically. Butt joints and locate over the centerlines of supports. Horizontally applied sheathing must be T&G, applied with tongued edge up. Stagger vertical joints and abut sheet closely to frames of openings. Nail sheathing with 11 gage, 3/8 inch head, zinc-coated nails 1-1/2 inches long for 1/2 inch sheathing and 1-3/4 inches long for 5/8 inch sheathing, spaced 3/8 inch minimum from edges. Provide 2 by 4 blocking for horizontal edges of 4 foot wide panels not otherwise supported.

- a. Gypsum Sheathing Board Used with Diagonal-Braced Framing: Sheathing must be either 2 or 4 feet wide. Apply sheathing 2 feet wide horizontally. Nail 4 inches maximum o.c. at edges and over intermediate bearings. Apply sheathing 4 feet wide either horizontally or vertically. Nail 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.
- b. Gypsum Sheathing Board Used with Unbraced Frames: Sheathing must be 4 feet wide and applied vertically. Extend sheathing over and nail to both sill and top plates. Nail 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.
- 4. Foil-Faced Insulative Sheathing

Apply sheathing vertically. But or overlap joints and locate over centerline of supports. Attach sheathing to framing with 1-1/4 inch, large, flat-head, 11 gage, galvanized roofing nails or 16 gage, 7/16 inch minimum crown, galvanized staples with 1-1/4 inch legs. For nonstructural application (with corner bracing), space fasteners 6 inches o.c. on all panel edges and 12 inches o.c. on intermediate supports, regardless of sheathing thickness, for studs not more than 24 inches o.c. For structural application (without corner bracing), for studs not more than 16 inches o.c., space fasteners 3 inches o.c. on all edges and 6 inches o.c. on intermediate members using minimum 0.115 inch thickness; for studs up to 24 inches o.c., space fasteners 3 inches o.c. on all edges and 3 inches o.c. on intermediate supports using minimum 0.137 inch thickness.

- 5. Particleboard
- Install according to manufacturer's instructions and accepted industry standards.
- 6. Cellulose Honeycomb Panels

Install according to manufacturer's instructions and accepted industry standards.

K. Wood Sheathing

Sheathing end joints must be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board must bear on at least three supports. Boards must be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width. Roof sheathing must not be installed where roof decking is installed.

L. Ceiling Joists

Size as indicated and set accurately and in alignment. Toe-nail joists to all plates with not less than three 10-penny nails. Frame openings in ceilings with headers and trimmers.

M. Metal Framing Anchors

Provide framing anchors at every other rafter to fasten to plates and studs against uplift movement and forces as indicated. Anchors must be punched and formed for nailing so that nails will be stressed in shear only. Nails must be zinc-coated; drive a nail in each nail hole provided in the anchor.

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N. Stair Framing

Cut carriages to exact shape required to receive treads and risers, with risers of uniform height and treads of uniform width. Provide trimmers, nailers, and blocking as required to support finish materials.

3.2 MISCELLANEOUS

- A. Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants Provide sizes and configurations indicated or specified and anchored securely to continuous construction.
 - 1. Roof Nailing Strips

Provide roof nailing strips for roof decks as indicated and specified herein. Apply nailing strips in straight parallel rows in the direction and spacing indicated. Strips must be surface applied.

- a. Surface-Applied Nailers: Must be 3 inches wide and of thickness to finish flush with the top of the insulation. Anchor strips securely to the roof deck with powder actuated fastening devices or expansion shields and bolts, spaced not more than 24 inches o.c. On decks with slopes of one inch or more, provide surface applied wood nailers for securing insulation and for nailing of roofing felts.
- b. Embedded Nailers: Must be nominal 2 by 3 with 2 inch sides beveled. Set and anchor nailers to finish flush with the roof deck surface.
- 2. Roof Edge Strips and Nailers

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers must be 6 inches wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM 4435

3. Crickets, Cants, and Curbs Provide wood saddles or crickets, cant strips, curbs for scuttles and ventilators, and wood nailers bolted to tops of concrete or masonry curbs and at expansion joints, as indicated, specified, or necessary and of lumber.

B. Rough Wood Bucks

Size as indicated. Set wood bucks true and plumb. Anchor bucks to concrete or masonry with steel straps extending into the wall 8 inches minimum. Place anchors near the top and bottom of the buck and space uniformly at 2-foot maximum intervals.

- C. Wood Blocking Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.
- D. Wood Grounds
 Provide for fastening wood trim, finish materials, and other items to plastered walls and ceilings. Install grounds in proper alignment and true with an 8-foot straightedge.
- E. Wood Furring

Provide where shown and as necessary for facing materials specified. Except as shown otherwise, furring strips must be nominal one by 3, continuous, and spaced 16 inches o.c. Erect furring vertically or horizontally as necessary. Nail furring strips to masonry. Do not use wood plugs. Provide furring strips around openings, behind bases, and at angles and corners. Furring must be plumb, rigid, and level and must be shimmed as necessary to provide a true, even plane with surfaces suitable to receive the finish required. Form furring for offsets and breaks in walls or ceilings on 1 by 4 wood strips spaced 16 inches o.c.

- F. Wood Bumpers Dress to the sizes indicated, and bevel edges. Bore, countersink, and bolt bumpers in place.
- G. Temporary Closures Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

SECTION 06 10 00 ROUGH CARPENTRY

H. Temporary Centering, Bracing, and Shoring

Provide for the support and protection of masonry work during construction. Forms and centering for cast-in-place concrete work are specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

I. Wood Sleepers

Run wood sleepers in lengths as long as practicable and stagger end joints in adjacent rows. Sleepers for gymnasium floors are specified in Section 09 64 66 WOOD ATHLETIC FLOORING.

J. Diaphragms

Install plywood, structural-use, or OSB panels with the long dimension parallel to supports. End joints must be staggered and located over the centerline of supports. Longitudinal joints must be staggered and provided with blocking. Nail panels with 8-penny nails spaced not more than 12 inches on centers around the diaphragm boundaries and along continuous panel edges and 12 inches on centers at all other supported edges and 12 inches o.c. over intermediate bearings.

K. Shear Walls

Install plywood or structural-use panels with long dimension parallel or perpendicular to supports. Provide blocking behind edges not located over supports. Nail panels with 8-penny nails spaced not more than 12 inches on centers along panel edges and 6 inches o.c. over intermediate bearings.

L. Bridging

Wood bridging must have ends accurately bevel-cut to afford firm contact and must be nailed at each end with two nails. Indall metal bridging as recommended by the manufacturer. The lower ends of bridging must be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

M. Corner Bracing

Indatall corner bracing when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing must be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, must extend completely over wall plates, and must be secured at each bearing with two nails.

N. Sill Plates

Sill plates must be set level and square and anchor bolted at not more than 6 feet on centers and not more than 12 inches from end of each piece. A minimum of two anchors must be used for each piece.

3.3 INSTALLATION OF TIMBER CONNECTORS

Install timber connectors in conformance with requirements of AWC NDS.

3.4 ERECTION TOLERANCES

- A. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, must be within the following limits:
 - 1. Layout of walls and partitions: 1/4 inch from intended position;
 - 2. Plates and runners: 1/4 inch in 8 feet from a straight line;
 - 3. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
 - 4. Face of framing members: 1/4 inch in 8 feet from a true plane.
- B. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive must be within the following limits:
 - 1. Layout of walls and partitions: 1/4 inch from intended position;
 - 2. Plates and runners: 1/8 inch in 8 feet from a straight line;
 - 3. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
 - 4. Face of framing members: 1/8 in 8 feet from a true plane.

SECTION 06 10 00 ROUGH CARPENTRY

3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS Special inspections and testing for seismic-resisting systems and components must be done in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

3.6 WASTE MANAGEMENT OF WOOD PRODUCTS

In accordance with the Waste Management Plan and as specified. Separate and reuse scrap sheet materials larger than 2 square feet, framing members larger than 16 inches, and multiple offcuts of any size larger than 12 inches. Clearly separate damaged wood and other scrap lumber for acceptable alternative uses on site, including bracing, blocking, cripples, ties, and shims. Separate composite wood from other wood types and recycle or reuse. Set aside scrap plastic lumber and return to manufacturer for recycling into new product. When such a service is not available, local recyclers must be sought after to reclaim the materials. Fold up metal banding, flatten, and recycle.

Separate treated, stained, painted, and contaminated wood and place in designated area for hazardous materials. Dispose of according to local regulations. Do not burn scrap lumber that has been pressure treated, or lumber that is less than one year old.

END OF SECTION 06 10 00

SECTION 06 10 00 ROUGH CARPENTRY

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SECTION 06 15 33 WOOD PATIO DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Plastic decking.
 - 2. Railings for elevated decks.
 - 3. Support framing for elevated decks.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

A. Product Data:

- 1. For plastic decking. Include installation instructions.
- B. Samples: For plastic decking, not less than 24 inches long, showing the range of variation to be expected in appearance of decking, including surface texture.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
 - 1. For compliance with Build America, Buy America Act.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Plastic decking.
 - 2. Expansion anchors.
 - 3. Metal framing anchors.
 - 4. Decking fasteners.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Handle and store plastic lumber to comply with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PLASTIC DECKING

A. Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.

SECTION 06 15 33 WOOD PATIO DECKING

- 1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, shall not be less than design loads and spans indicated.
- B. Composite Plastic Lumber: Solid shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.
 - 1. <u>Basis of Design:</u> Trex Transcend Lineage Composite Decking.
 - 2. Decking Standard: ICC-ES AC109 or ICC-ES AC174.
 - 3. Decking Size: 1 by 5-1/2 inches actual.
 - 4. Configuration: Provide product with grooved edges designed for fastening with concealed decking fasteners.
 - 5. Surface Texture: Manufacturer's standard.
 - 6. Color: As selected by Architect from manufacturer's full range.

2.2 DECK AND RAMP RAILING

- A. Basis of design: Trex Transcend Railing
 - 1. Configuration: Manufacturers standard such that a 4" ball cannot pass.
 - 2. Surface Texture: Manufacturer's standard.
 - 3. Color: As selected by Architect from manufacturer's full range.

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture.
 - 1. Use fasteners as recommended by the decking manufacturer.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Install plastic lumber to comply with manufacturer's written instructions.
- D. Secure decking to framing with manufacturers recommended attachment device.
- E. Install metal framing anchors to comply with manufacturer's written instructions.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- H. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

3.4 ELEVATED DECK JOIST FRAMING INSTALLATION

- A. General: Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.
- B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

SECTION 06 15 33 WOOD PATIO DECKING

- C. Lap members framing from opposite sides of beams or girders not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- D. Provide solid blocking of 2-inch nominal thickness by depth of joist at intervals of 96 inches o.c., between joists.

END OF SECTION 06 15 33

SECTION 06 15 33 WOOD PATIO DECKING

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SECTION 06 16 00 SHEATHING

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

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- A. Section Includes:
 - 1. Wall sheathing.
 - Related Requirements:
 - 1. Section 06 10 53 "Miscellaneous Rough Carpentry"

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
 - 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Fire-retardant-treated plywood.
 - Field quality-control reports.
- C. Certification of compliance with the Build America, Buy America Act.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Testing Agency Qualifications:
 - 1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

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

SECTION 06 16 00 SHEATHING

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fireretardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.

2.4 WALL SHEATHING

- A. Plywood Sheathing: Exterior sheathing.
 - 1. Span Rating: Not less than 32/16.
 - 2. Nominal Thickness: Not less than 1/2 inch.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

SECTION 06 16 00 SHEATHING

- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

2.6 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Space panels 1/8 inch apart at edges and ends.

3.3 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

END OF SECTION 06 16 00

SECTION 06 16 00 SHEATHING

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SECTION 06 20 23 INTERIOR FINISH CARPENTRY

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. Interior trim, including non-fire-rated interior doorframes.
- 2. Shelving and clothes rods.

1.3 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. MDO: Plywood with a medium-density overlay on the face.
- C. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
 - 3. Certification of Compliance with the Build America Buy America Act
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.
- D. Certification of Compliance with the Build America Buy America Act

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 - 1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 - 2. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

SECTION 06 20 23 INTERIOR FINISH CARPENTRY

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece
- B. Softwood Plywood: DOC PS 1.
- C. Hardboard: ANSI A135.4.
 - 1. Color: Interior Trim is unfinished and will be prepped to be stained.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category **UC1**.

- 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
- 2. Preservative Chemicals: Acceptable to authorities having jurisdiction.
- 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
- 4. Do not use material that is warped or does not comply with requirements for untreated material.
- 5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- 6. Application: Around all doors, windows, and trim base flooring. Upstairs and doorstairs. Where indicated on Drawings

2.3 INTERIOR TRIM

- A. Softwood Lumber Trim for Transparent Finish (Stain):
 - 1. Species and Grade: Eastern white pine; NeLMA or NLGA Unfinished
 - 2. Mastercraft 7/16" x 5 ¼ x 12' unfinished pine base molding E1E
 - 3. Maximum Moisture Content: 8 percent with at least 85 percent of shipment at 8 percent or less].
 - 4. Finger Jointing Allowed.
 - 5. Face Surface: (smooth)]
 - 6. Color, Texture, Grain Pattern: Minwax Mulverry MW 473

2.4 SHELVING AND CLOTHES RODS

- A. Closet Shelving: Made from the following material, 3/4 inch thick:
 - 1. Softwood Boards: Kiln-dried Douglas fir-larch, Douglas fir south, or hem-fir; SPIB Superior or C & Btr finish; NLGA, WCLIB, or WWPA; or southern pine; B & B finish.
- B. Shelf Cleats: 3/4-by-5-1/2-inch boards with hole and notch to receive clothes rods, as specified above for shelving.
- C. Clothes Rods: 1-1/2-inch-diameter, clear, kiln-dried Douglas fir or southern pine.
- D. Rod Flanges: Clear, kiln-dried, Douglas fir or southern pine turnings with clear finish.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

SECTION 06 20 23 INTERIOR FINISH CARPENTRY

B. Low-Emitting Materials: Adhesives shall comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
 - 1. Interior standing and running trim, except shoe and crown molds.
 - 2. Wood-board paneling.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
 - 1. Do not use pieces less than 24 inches long, except where necessary.
 - 2. Stagger joints in adjacent and related standing and running trim.
 - 3. **Miter** at returns, miter at outside corners, and cope at inside corners to produce tightfitting joints with full-surface contact throughout length of joint.
 - 4. Use scarf joints for end-to-end joints.
 - 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

SECTION 06 20 23 INTERIOR FINISH CARPENTRY

- 6. Match color and grain pattern of trim for transparent finish (stain) across joints.
- 7. Install trim after gypsum-board joint finishing operations are completed.
- 8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
- 9. Fasten to prevent movement or warping.
- 10. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

Α.

- Replace interior finish carpentry that is damaged or does not comply with requirements.
 - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 23

SECTION 06 41 13 WOOD-VENEER-FACED ARCHITECTURAL CABINETS

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. Wood-veneer-faced architectural cabinets.
- 2. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not concealed within other construction.
- 3. Shop finishing of architectural cabinets.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: For architectural cabinets.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show large-scale details.
 - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 4. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
 - 5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 - 6. Apply AWI Quality CertificationProgram label to Shop Drawings.
- C. Samples: For each exposed product and for each color and finish specified, in manufacturer's standard size.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For the following:
 - 1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches longfor each species and cut, finished on one side and one edge.
 - 2. Veneer Leaves: Representative of and selected from flitches to be used for transparentfinished cabinets.
 - 3. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color.
 - 4. Thermoset Decorative Panels: 8 by 10 inches, for each color, pattern, and surface finish.
 - a. Provide edge banding on one edge.
 - 5. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 - 6. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

SECTION 06 41 13 WOOD-VENEER-FACED ARCHITECTURAL CABINETS

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For the following:
 - 1. Composite wood and agrifiber products.
 - 2. Adhesives.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.
- D. Field quality-control reports.
- E. Certificate of Compliance with the Build America, Buy America Act

1.6 CLOSEOUT SUBMITTALS

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 > percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

- A. Source Limitations: Engage a qualified woodworking firm to assume responsibility for production of architectural cabinets
 - 1. Manufacturer: Woodland Cabinetry
 - 2. Door Style:
 - 3. Kitchen Cabinet Material: MDF Color:
 - 4. Bathrooms Cabinets Material: Rustic Hickory Stain:

SECTION 06 41 13 WOOD-VENEER-FACED ARCHITECTURAL CABINETS

2.2 CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.3 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: Economy.
- B. Type of Construction: Frameless
- C. Door and Drawer-Front Style: Flush overlay
 - 1. Reveal Dimension: Top and bottom reveal is 3/32"
 - 2. Reveal Dimension: Between doors and drawer fronts 3/16"
- D. Wood for Exposed Surfaces:
 - 1. Species: Rustic Hickory STAIN:Spice DOORSTYLE: Taylor :
- E. Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces
 - 2. Drawer Bottoms: Hardwood plywood
- F. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued dovetail joints.

2.4 WOOD CABINETS FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: Economy.
- B. Type of Construction: Frameless
- C. Door and Drawer-Front Style: Flush overlay
 - 1. Reveal Dimension: Top and bottom reveal is 3/32"
 - 2. Reveal Dimension: Between doors and drawer fronts 3/16"
- D. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.
- E. Panel Product for Exposed Surfaces:MDF .COLOR:White DOORSTYLE: Taylor
- F. Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Match materials indicated for exposed surfaces
 - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber]
 - 3. Drawer Bottoms: Hardwood plywood
- G. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued dovetail joints
- 2.5 WOOD MATERIALS
 - A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 - 2. Wood Moisture Content: 5 to 10 percent.
 - B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

SECTION 06 41 13 WOOD-VENEER-FACED ARCHITECTURAL CABINETS

- 1. MDF: ANSI A208.2, Grade 130
- 2. Particleboard: ANSI A208.1, Grade M-2
- 3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
- 4. Softwood Plywood: DOC PS 1 MDF

2.6 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Door Locks: BHMA A156.11, E07121.
- D. Door and Drawer Silencers: BHMA A156.16, L03011.
 - 1. Satin Stainless Steel: BHMA 630.
- E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.7 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.8 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease edges and corners to 1/16-inch radius unless otherwise indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.9 SHOP FINISHING

- A. General: Finish architectural cabinets at manufacturer's shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. General: Shop finish transparent-finished architectural cabinets at manufacturer's shop as specified in this Section. See Section 09 91 23 "Interior Painting" for field finishing of opaque-finished architectural cabinets.
- C. General: Drawings indicate items that are required to be shop finished. Finish these items at manufacturer's shop as specified in this Section. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished items specified to be field finished.
- D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural cabinets, as applicable to each unit of work.
- E. Transparent Finish:

SECTION 06 41 13 WOOD-VENEER-FACED ARCHITECTURAL CABINETS

- 1. Architectural Woodwork Standards Grade: Same as item to be finished.
- 2. Sheen: Standard sheen from Woodland Cabinetry
- F. Opaque Finish:
 - 1. Architectural Woodwork Standards Grade: Same as item to be finished.
 - 2. Color: Kitchen: White
 - 3. Color: Bathrooms: Stain Spice
 - 4. Sheen: Standard sheen from manufacturer gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with cabinet surface.
 - 1. For shop-finished items, use filler matching finish of items being installed.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips
- E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- F. Field Finishing: See Section 09 91 23 "Interior Painting" and Section 09 93 00 "Staining and Transparent Finishing" for finishing of installed architectural cabinets.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Programcertifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 1. Inspection entity shall prepare and submit report of inspection.

3.4 ADJUSTING AND CLEANING

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

SECTION 06 41 13 WOOD-VENEER-FACED ARCHITECTURAL CABINETS

C. Clean cabinets on exposed and semiexposed surfaces. Touch up finishes to restore damaged or soiled areas.

END OF SECTION 06 41 13

SECTION 06 43 00 WOOD STAIRS AND RAILINGS

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. Wood stairs and railings.
 - 2. Shop finishing of wood stairs and railings.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- B. Samples for Initial Selection:
 - 1. Shop-applied transparent finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.
- B. Product Certificates: For the following:
 - 1. Composite wood and agrifiber products.
 - 2. Adhesives.
- C. Woodwork Quality Standard Compliance Certificates: WI Quality Certification Program certificates.
- D. Certification of compliance with the Build America, Buy America Act.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful inservice performance.
- B. Installer Qualifications: Licensee of WI's Certified Compliance Program.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wood stairs and railings until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where wood stairs and railings are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood stairs and railings can be supported and installed as indicated.

SECTION 06 43 00 WOOD STAIRS AND RAILINGS

PART 2 - PRODUCTS

2.1 WOOD STAIRS AND RAILINGS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from WI certification program indicating that woodwork complies with requirements of grades specified.
 - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium
- C. Wood for Transparent Finish: Quarter-sawn, red-oak treads; plain-sawn, hard-maple handrails.
- D. Finishes for Stair Parts: As follows:
 - 1. Handrails: Transparent
 - 2. All others to be covered by LVP.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
 - 2. Wood Moisture Content: 5 to 10 percent.

2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber kiln dried to less than 15 percent moisture content.
- B. Rough Carriages for Stairs: Select Structural grade and any of the following species, kiln dried to 15 percent maximum moisture content:
 - 1. Hem-fir (north).
 - 2. Southern pine.
 - 3. Douglas fir-larch.
 - 4. Douglas fir-larch (north).
 - 5. Spruce-pine-fir.
 - 6. Hem-fir.
 - 7. Douglas fir-south.
 - 8. Spruce-pine-fir (south).
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.4 FABRICATION

- A. Fabricate wood stairs and railings to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

SECTION 06 43 00 WOOD STAIRS AND RAILINGS

- 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Cut carriages to accurately fit treads and risers. Glue treads to risers, and glue and nail treads and risers to carriages.
 - 1. Fabricate stairs with treads and risers no more than 1/8 inch (3 mm) from indicated position and no more than 1/16 inch (1.5 mm) out of relative position for adjacent treads and risers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition wood stairs and railings to average prevailing humidity conditions in installation areas.
- B. Before installing wood stairs and railings, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
- 3.2 INSTALLATION
 - A. Grade: Install wood stairs and railings to comply with same grade as item to be installed.
 - B. Assemble wood stairs and railings and complete fabrication at Project site to the extent that it was not completed in the shop.
 - C. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 inch (3 mm) from indicated position.
 - D. Railings:
 - 1. General: Install rails with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.
 - Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
 a. Space rail brackets not more than 48 inches o.c.
 - E. Touch up finishing work specified in this Section after installation of wood stairs and railings. Fill nail holes with matching filler where exposed.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.
 - F. Refer to Section 09 93 00 "Staining and Transparent Finishing" for final finishing of installed wood stairs and railings.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective wood stairs and railings, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood stairs and railings. Adjust joinery for uniform appearance.
- B. Clean wood stairs and railings on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 43 00

SECTION 06 43 00 WOOD STAIRS AND RAILINGS

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DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 - GENERAL

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

- A. Certification of compliance with Build America, Buy America Act.
- B. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Owens Corning.
 - B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

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- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm) below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 25 00 WEATHER BARRIERS

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. Building wrap.
 - 2. Flexible flashing.
- 1.3 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
 - B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.
- 1.4 INFORMATIONAL SUBMITTALS
 - A. Evaluation Reports: For water-resistive barrier, from ICC-ES.

PART 2 - PRODUCTS

- 2.1 WATER-RESISTIVE BARRIER
 - A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 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. Dow Chemical Company (The).
 - b. DuPont Building Innovations: E. I. du Pont de Nemours and Company.
 - c. Raven Industries, Inc.
 - Water-Vapor Permeance: Not less than (4300 ng/Pa x s x sq. m) (1150 ng/Pa x s x sq. m) 8 perms (460 ng/Pa x s x sq. m) per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 - 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg (0.02 L/s x sq. m at 75 Pa) when tested according to ASTM E 2178.
 - 4. Allowable UV Exposure Time: Not less than three months.
 - 5. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
 - B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

- A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than (0.6 mm) 0.030 inch (0.8 mm) (1.0 mm).
 - 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. DuPont Building Innovations: E. I. du Pont de Nemours and Company.

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- Grace Construction Products; W.R. Grace & Co. -- Conn. b.
- Protecto Wrap Company. c.
- Raven Industries. Inc. d.
- Flame Propagation Test: Materials and construction shall be as tested according to 2. NFPA 285.
- Β. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

PART 3 - EXECUTION

WATER-RESISTIVE BARRIER INSTALLATION 3.1

- Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to Α. framing immediately after sheathing is installed.
- Cover sheathing with water-resistive barrier as follows: Β.
 - Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at 1. expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.
- C. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails. D.
 - Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 - Seal seams, edges, fasteners, and penetrations with tape. 1.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

Apply flexible flashing where indicated to comply with manufacturer's written instructions. Α.

- Prime substrates as recommended by flashing manufacturer. 1
- 2. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
- Lap flashing over water-resistive barrier at bottom and sides of openings. 3.
- Lap water-resistive barrier over flashing at heads of openings. 4.
- 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 07 25 00
SECTION 07 31 13 WOOD STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fiberglass asphalt shingles over underlayment nailed to roof sheathing.
- 1.2 RELATED REQUIREMENTS
 - A. Counterflashing and Flashing of Roof Projections: Section 07 60 00, FLASHING AND SHEET METAL.
 - B. Shingle Color: Match existing.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - 1. D226/D226M-09 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 2. D1970/D1970M-15a Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - 3. D3018/D3018M-11 Class A Asphalt Shingles Surfaced with Mineral Granules.
 - 4. D3161/D3161M-15 Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method).
 - 5. D3462/D3462M-10a Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
 - 6. F1667-05(2011) Driven Fasteners: Nails, Spikes, and Staples.
- C. UL LLC (UL):
 - 1. 790-14 Fire Tests of Roof Coverings.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certification of compliance with Build America, Buy America Act
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
 - 3. Warranty.
- D. Samples:
 - 1. Shingles: Full size each type, color and texture.
- E. Sustainable Construction Submittals:
 - 1. Solar Reflectance Index (SRI) for asphalt shingles.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, manufacture date, and the label of Underwriters Laboratories.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

- A. Store shingles according to manufacturer's instructions. Store roll goods on end in upright position.
- B. Protect products from damage during handling and construction operations.
- C. Keep materials dry, covered completely, and protected from weather.

SECTION 07 31 13 WOOD STAIRS AND RAILINGS

- 1.7 WARRANTY
 - A. Manufacturer's Warranty: Warrant asphalt shingles against material and manufacturing defects.
 - 1. Material Warranty Period: 25 years.
 - 2. Wind-Speed Warranty Period: Resist wind speeds up to 130 mph for 15 years.
 - 3. Algae-Resistance Warranty Period: Lifetime.

PART 2 - PRODUCTS

- 2.1 PRODUCTS GENERAL
 - A. Provide each product from one manufacturer.
 - 1. Provide each product exposed to view from one production run.
 - B. Sustainable Construction Requirements:
 - 1. Asphalt Shingle Recycled Content: 50 percent post-consumer recycled content, minimum.
 - 2. Solar Reflectance Index: 29, minimum.

2.2 ASPHALT SHINGLES

- A. Asphalt Shingles:
 - 1. Approved Shingles:
 - a. Malarkey Legacy Scotchgard
 - b. Pre-Approved Equivalent
 - 1) Contractor shall provide documentation verifying equivalence or greater
 - 2. ASTM D7158 Class H
 - 3. ASTM D3462
 - 4. ASTM D3161 Class F
 - 5. ASTM D3018, Type I
 - 6. ASTM E108 Class A Fire Rating
 - 7. CSA A123.5
 - 8. FBC Approval #14809
 - 9. UL 2218 Class 4
 - 10. ICC Approval ESR-3150
 - 11. ICC-ES AC438

2.3 ROOFING NAILS

- A. ASTM F1667, Type I, Style 20, galvanized steel, deformed shanks, heads 3/8 inch to 7/16inch diameter.
 - 1. Nails for Shingles: 1-1/4 inches long.
 - 2. Nails for Felt: 3/4 inch long.

2.4 ROOFING UNDERLAYMENT

- A. Organic Felt: ASTM D226/D226M, Type I, number 15
- B. Self-Adhering Modified Bituminous Underlayment: ASTMD1970/D1970M.
- C. Leak Barrier Underlayment Self-adhering leak barrier or ice dam underlayment must comply with ASTM D1970 for sealability around nails.
- 2.5 METAL FLASHING
 - A. Provide metal roof flashings, including apron flashings, step flashings, valley flashings, drip edges, and vent pipe flashings specified in Section 07 60 00, FLASHING AND SHEET METAL.

SECTION 07 31 13 WOOD STAIRS AND RAILINGS

2.6 RIDGE VENTS

- A. Ridge Vents: Manufacturer's standard ridge vent for use under asphalt shingles.
 - 1. Provide ridge vents with internal filters, internal baffles, or external baffles, for weather protection.
 - 2. Free Area: Minimum 12 sq. inches per foot.
- 2.7 SNOW GUARDS
 - A. Snow Guards: Stainless steel or aluminum individual snow guards designed for use with asphalt shingles.
 - 1. Color: Provide color samples to owner for selection.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for roofing installation.
 - 1. Verify roof substrates are sound, within manufacturer's tolerances, and free from defects which would interfere with roofing installation.
 - 2. Verify roof accessories, vent pipes and other projections through roof are in place and roof flashing is installed, or ready for installation, before installing shingles.
- B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 METAL DRIP EDGE INSTALLATION

- A. At eaves and rakes, install stainless steel drip edges specified in Section 07 60 00, FLASHING AND SHEET METAL.
 - 1. Eaves: Install metal drip edge before underlayment.
 - 2. Rakes: Install metal drip edge after underlayment.
- B. Secure metal drip edges with compatible nails spaced maximum 10 inches on center along inner edges.

3.4 FLASHING INSTALLATION

- A. Install metal flashings specified in Section 07 60 00, FLASHING AND SHEET METAL at intersections of roofs, adjoining walls, or projections through deck such as chimneys and vent stacks.
- B. Install metal valley flashing shown and as specified under Section 07 60 00, FLASHING AND SHEET METAL.
 - 1. Secure valley flashing according to shingle manufacturer's instructions.
 - 2. Expose flashing in open portion of valley 5 inches minimum, and lap shingles over flashing 5 inches minimum.

3.5 UNDERLAYMENT INSTALLATION

- A. Install self-adhering sheet underlayment, working from low point to high point. Lap sides 3-1/2 inches minimum, and lap ends 6 inches minimum. Install at the following locations:
 - 1. Eaves and Rakes: From edge of eave and rake to 24 inches minimum beyond inside face of exterior wall.
 - a. Lap underlayment over eave metal drip edge.
 - 2. Valleys, Hips and Roof Slope Transitions: Centered over change in slope and extended 18 inches minimum on both sides.

SECTION 07 31 13 WOOD STAIRS AND RAILINGS

- 3. Ridges: Centered on ridge, and extended 36 inches minimum on both sides. Do not cover ridge vent opening.
- 4. Sidewalls and Projections through Roof: Extended 18 inches from projection, and extended up projection 4 inches minimum.
- 5. Firmly roll underlayment to ensure adhesion to roof deck and metal flashings.
- B. Install organic felt underlayment on roof deck not covered by self-adhering sheet underlayment, with 4 inches minimum end laps, 2 inches minimum head laps, and 12 inches minimum ridge laps. Nail felt 5 inches on centers along laps.
- 3.6 ROOF ACCESSORY INSTALLATION
 - A. Install roof hatches (scuttles), and roof vents, specified in Section 07 71 00, ROOF SPECIALTIES before installing shingles.
 - B. Install skylights specified in Section 08 63 00, METAL-FRAMED SKYLIGHTS before installing shingles.
 - C. Lap underlayment and asphalt shingles over upslope base flanges of roof accessory flashings.
 - D. Install underlayment and asphalt shingles over sideslope base flanges of roof accessory flashings.
 - E. Install downslope base flanges of roof accessories over asphalt shingles.

3.7 ASPHALT SHINGLE INSTALLATION

- A. Install shingles aligned parallel to roof eave, nailed to roof sheathing.
 - 1. Exposure: 5 inches maximum.
 - 2. Headlap: 2 inches minimum.
- B. Install asphalt-shingle starter strip with tabs removed, and overhanging lower edge of roof 1/2 inch.
- C. Valleys: Closed.

3.8 RIDGE VENT INSTALLATION

- A. Install ridge vents over shingles.
 - 1. Extent: Continuous along ridges extending to within 24-inches of rakes.

3.9 HIP AND RIDGE SHINGLE INSTALLATION

- A. Bend each shingle lengthwise down center to provide equal exposure on both sides of hip and ridge.
 - 1. Begin ridge installation at leeward end of ridge. Cover ridge vents with shingles. Do not cover ridge vent openings with ridge shingles.
 - 2. Begin hip installation at eave.
- B. Install shingles with maximum 5 inches exposure.
- C. Secure each shingle with one nail on both sides of hip and ridge, 8-1/2 inches back from exposed end and one inch up from edge.

3.10 SNOW GUARD INSTALLATION

- A. Install snow guards in layout recommended by manufacturer.
 - 1. Fasten snow guards with fasteners concealed by shingles.

END OF SECTION 07 31 13

SECTION 07 41 00 SEALANTS AND CAULKING

PART 1 – GENERAL

- 1.1 DESCRIPTION OF WORK
 - A. Throughout work seal and caulk joints in sheet metal work where shown on drawings and elsewhere as required to provide a barrier against air and moisture seepage.

PART 2 - PRODUCTS

- 2.1 SEALANT
 - A. Caulking/sealant shall be one component polyurethane type meeting Federal Specification TT-S00230C.
 - 1. Manufacturers providing products which meet or exceed above specified requirements include the following:
 - a. Tremco (Dymonic)
 - b. PRC Corporation (Permapol RC-1)
 - c. Sonneborn (NP-1)
 - 2. Sealant shall be colored to match prefinished metal or mortar joints. Up to two different colors may be required.
 - 3. Use only one type of sealant throughout the project.
 - B. Primers
 - 1. In most cases, joints to be sealed will not require primer. It shall be the sole responsibility of the contractor to refer to sealant manufacturer's written directions as to whether specific joints to be sealed will or will not require primer prior to application of sealant.
 - 2. Where priming is required use only those primers which are non-staining, have been tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by the manufacture of the sealant used.
 - C. Rod Stock
 - 1. Use rod stock backup materials which are recommended by sealant manufacturer. When installed in joint rod stock backup shall be compressed 25 to 50% for secure fit. Do not twist, braid, cut or puncture rod stock upon installation.
 - D. Bond Breaker
 - 1. Provide an approved bond-breaker where recommended by the manufacturer of the sealant.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Concrete and/or Masonry Surfaces
 - 1. Install only on surfaces which are dry, sound, and well brushed, wiping free dust.
 - 2. At open joints, remove dust by mechanically blown compressed air if so required.
 - 3. Use solvent to remove oil and grease, wiping the surfaces with clean rags.
 - 4. Thoroughly remove existing sealant at joints which are to be re-sealed by use of wire brush, scraper and or solvent.
 - 5. Where backstop is required, insert the approved backup material into the joint cavity to the depth needed.
- B. Sheet Metal
 - 1. On prefinished metal removed protective plastic film prior to application of sealant.
 - 2. On galvanized metal use solvent to remove ail and grease prior to application of sealant. Wipe surfaces free of solvent with rags.
- 3.2 INSTALLATION
 - A. Prior to start of installation in each joint, verify the joint type according to details on the drawings and verify that the required proportion of width of joint to depth of joint has been secured.
 - B. Clean joint to be caulked free of dust, dirt, loose caulking, rust, etc., to assure firm adhesion of sealant on both sides of joint.
 - C. Equipment:

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- 1. Apply sealant under pressure with power-actuated or hand gun, or by other appropriate means.
- 2. Use guns with nozzle of proper size, and providing sufficient pressure to completely fill the joints as designed.
- D. Install the sealant in strict accordance with the manufacturer's recommendations, thoroughly filling joints to the recommended depth.
- E. Total joints to the profile shown on the drawings, or as otherwise required if such profiles are not shown on the drawings. <u>Un-tooled joints will be rejected</u>.
- F. Cleaning up:
 - 1. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.

END OF SECTION 07 41 00

SECTION 07 60 00 FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING					
	ASHRAE 90.1 - IP	Energy Standard for Buildings Except Low-Rise Residential Buildings			
	ASHRAE 90.1 - SI	Energy Standard for Buildings Except Low-Rise Residential Buildings			
	ASHRAE 189.1	Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings			
AN	IERICAN WELDING SOCIET AWS D1.2/D1.2M	۲Y (AWS) Structural Welding Code - Aluminum			
AS	TM INTERNATIONAL (ASTN ASTM A308/A308M	 M) Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot Dip Process 			
	ASTM A480/A480M	Standard Specification for General Requirements for Flat- Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip			
	ASTM A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process			
	ASTM B32	Standard Specification for Solder Metal			
	ASTM B69	Standard Specification for Rolled Zinc			
	ASTM B101	Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction			
	ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate			
	ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes			
	ASTM B370	Standard Specification for Copper Sheet and Strip for Building Construction			
	ASTM C1549	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer			
	ASTM D41/D41M	Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing			

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ASTM D226/D226M	Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing			
ASTM D1784	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds			
ASTM D4586/D4586M	Asphalt Roof Cement, Asbestos-Free			
ASTM E408	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques			
ASTM E971	Standard Practice for Calculation of Photometric Transmittance and Reflectance of Materials to Solar Radiation			
ASTM E1918	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field			
ASTM E1980	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces			
SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION				
SMACNA 1793	Architectural Sheet Metal Manual, 7th Edition			
SINGLE PLY ROOFING INDUSTRY (SPRI) ANSI/SPRI RD-1 Performance Standard for Retrofit Drains				

U.S. DEPARTMENT OF ENERGY (DOE) Energy Star Energy Efficiency Labeling System (FEMP)

1.2 GENERAL REQUIREMENTS

Finished sheet metal assemblies must form a weathertight enclosure without waves, warps, buckles, fastening stresses or distortion, while allowing for expansion and contraction without damage to the system. The sheet metal installer is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal modifications required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous, uninterrupted roofing operations.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Certification of compliance with Build America, Buy America Act.
- B. Shop Drawings
 - 1. Exposed Sheet Metal Coverings
 - 2. Flashing at Roof Penetrations and Equipment Supports
 - 3. Reglets
 - 4. Conductor Heads
 - 5. Recycled Content
- C. Product Data
 - 1. Cool Roof Data
- D. Finish Samples
- E. Manufacturer's Instructions for Installation

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- F. Quality Control Plan
- G. Operation and Maintenance Data Cleaning and Maintenance

1.4 MISCELLANEOUS REQUIREMENTS

A. Product Data

Indicate thicknesses, dimensions, fastenings, anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

- B. Finish Samples Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.
- C. Operation and Maintenance Data Submit detailed instructions for installation and quality control during installation, cleaning and maintenance, for each type of assembly indicated.

1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until installation.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

2.2 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA 1793 for a particular item, unless otherwise indicated. Provide materials, thicknesses, and configurations in accordance with SMACNA 1793 for each material. Different items need not be of the same metal, except that[if copper is selected for any exposed item, all exposed items must be copper, and that] contact between dissimilar metals must be avoided.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used, except as follows:

A. Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fascia; cap, valley, steeped, base, and eave flashings and related accessories.

- B. Steel Sheet, Zinc-Coated (Galvanized)
- Provide in accordance with ASTM A653/A653M. C. Zinc Sheet and Strip
- Provide in accordance with ASTM B69, Type I, a minimum of 0.024 inch thick.
- D. Stainless Steel Provide in accordance with ASTM A480/A480M, Type 302 or 304, 2D Finish, fully annealed,

SECTION 07 60 00 FLASHING AND SHEET METAL

dead-soft temper.

E. Aluminum Alloy Sheet and Plate

Provide in accordance with ASTM B209M ASTM B209 anodized or color form alloy, and temper appropriate for use. Provide material not less than 0.065-in in thickness.

1. Alclad

When fabricated of aluminum, fabricate the following items with Alclad 3003, Alclad 3004, or Alclad 3005, clad on both sides unless otherwise indicated.

- a. Gutters, downspouts, and hangers
- b. Gravel stops and fascia
- c. Flashing
- F. Finishes

Provide exposed exterior sheet metal and aluminum with a baked on, factory applied color coating of polyvinylidene fluoride (PVF2) or approved equal fluorocarbon coating. Dry film thickness of coatings must be 0.8 to 1.3 mils. Color to be selected from manufacturer's full range of "cool roof" color choices. Field applications of color coatings are prohibited and will be rejected.

G. Cool Roof Finishes

Provide cool roof finish coatings and colors in accordance with one of the following methods of analysis:

1. Energy Star Certification

Provide roof finishes having an initial solar reflectance of 0.25 for steep slope roofs with a greater than 2:12 pitch when tested in accordance with ASTM E971, or as certified by Energy Star for the particular product proposed. Certified Energy Star roof products are listed at <u>https://www.energystar.gov/productfinder/product/certified-roof-products/results</u>

- 2. ASHRAE 189.1 Compliance Provide roof finishes having a minimum initial Solar Reflectance Index of 29 for steep slope roofs with a greater than 2:12 pitch when tested in accordance with ASTM E971, to comply with ASHRAE 189.1.
- 3. ASHRAE 90.1 Compliance

Provide roof finishes having a minimum 3-year aged solar reflectance of 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and a minimum 3-year aged thermal emittance of 0.75 when tested in accordance with ASTM E971 or ASTM E408, or, a minimum 3-year aged Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU per h ft2, to comply with ASHRAE 90.1 – SI, ASHRAE 90.1 - IP. Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes ASTM B221MASTM B221.

H. Solder

Provide in accordance with ASTM B32, 95-5 tin-antimony.

- I. Asphalt Primer Provide in accordance with ASTM D41/D41M.
- J. Fasteners

Use the same metal as, or a metal compatible with the item fastened.

PART 3EXECUTION

3.1 INSTALLATION

A. Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction. Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever

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indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

B. Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inches. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work. Secure flashing at one-half the normal interval to ensure a wind-resistant installation.

C. Cleats

Provide cleats for sheet metal 18 inches and over in width. Space cleats evenly not over 12 inches on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of 2 inches wide by 3 inches long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. Pre-tin cleats for soldered seams.

D. Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inches or less in thickness.

E. Seams

Straight and uniform in width and height with no solder showing on the face.

1. Flat-lock Seams

Finish not less than 3/4 inch wide.

2. Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

3. Loose-Lock Expansion Seams

Not less than 3 inches wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 1/8-inch-thick bed.

4. Standing Seams

Not less than one inch high, double locked without solder.

- Flat Seams Make seams in the direction of the flow.
- F. Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pre-tin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

1. Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pre-tinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

G. Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

1. Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

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2. Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inches maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inches from the end of the overlapping sheet.

- H. Protection from Contact with Dissimilar Materials
 - 1. Copper or Copper-bearing Alloys Paint with heavy-bodied bituminous paint surfaces in contact with dissimilar metal or separate the surfaces by means of moisture proof building felts.
 - 2. Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint. Aluminum may be used over concrete construction, provided that required reglets are of stainless steel and aluminum surface in contact with concrete or masonry is coated with bituminous paint or zinc chromate primer.

- 3. Metal Surfaces Paint surfaces in contact with mortar, concrete, or other masonry materials with alkaliresistant coatings such as heavy-bodied bituminous paint.
- 4. Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

I. Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascia by expansion and contraction joints spaced not more than 12 feet apart.

J. Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inches above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inches. Fold the exposed edges of counterflashings 1/2 inch. Where stepped counterflashings are required, they may be installed in short lengths a minimum 8 inches by 8 inches or may be of the preformed single piece type. Provide end laps in counter-flashings not less than 3 inches and make it weathertight with plastic cement. Do not make lengths of metal counter-flashings exceed 10 feet. Form flashings to the required shapes before installation. Factory form corners not less than 12 inches from the angle. Secure the flashings in the reglets with lead wedges and space not more than 18 inches apart: on chimneys and stair/elevator towers short runs, place wedges closer together. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counter-flashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inches into the walls. Install counterflashing to provide a spring action against base flashing. Where bituminous base flashings are provided, extend down the counter flashing as close as practicable to the top of the cant strip. Factory form counter flashing to provide spring action against the base flashing.

K. Metal Reglets

Keep temporary cores in place during installation. Ensure factory fabricated caulked type or friction type, reglets have a minimum opening of 1/4 inch and a minimum depth of 1-1/4 inch, when installed.

1. Caulked Reglets

Wedge flashing in reglets with lead wedges every 18 inches, caulked full and solid with an approved compound.

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2. Friction Reglets

Install flashing snap lock receivers at 24 inches on center maximum. When flashing has been inserted the full depth of the slot, caulk the slot, lock with wedges, and fill with sealant.

- L. Polyvinyl Chloride Reglets for Temporary Construction Rigid polyvinyl chloride reglets may be provided in lieu of metal reglets for temporary construction.
- M. Metal Drip Edges

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inches and secure with compatible nails spaced not more than 10 inches on center along upper edge.

- N. Sheet Metal Covering on Flat, Sloped, or Curved Surfaces Except as specified or indicated otherwise, cover and flash all minor flat, sloped, or curved surfaces such as crickets, bulkheads, dormers and small decks with metal sheets of the material used for flashing; maximum size of sheets, 16 by 18 inches. Fasten sheets to sheathing with metal cleats. Lock seams and solder. Lock aluminum seams as recommended by aluminum manufacturer. Provide an underlayment of roofing felt for all sheet metal covering.
- O. Flashing at Roof Penetrations and Equipment Supports Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck.
- P. Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inches on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inches. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inches roof flange in bituminous plastic cement and nailed 3 inches on center. Extend sleeve a minimum of 8 inches above the roof deck and lapped a minimum of 3 inches by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

Q. Stepped Flashing

Provide stepped flashing where sloping roofs surfaced with shingles abut vertical surfaces. Place separate pieces of base flashing in alternate shingle courses.

R. Copings

Provide coping with locked and soldered seam. Terminate outer edges in edge strips. Install with sealed lap joints or standing seam joints as indicated.

3.2 PAINTING

Touch ups in the field may be applied only after metal substrates have been cleaned and pretreated in accordance with manufacturer's written instructions and products. Field-paint sheet metal for separation of dissimilar materials.

1. Aluminum Surfaces

Clean with solvent and apply one coat of zinc-molybdate primer and one coat of aluminum paint.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

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Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

- A. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- B. Verification that specified material is provided and installed.
- C. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.
- D. Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Project Manager at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	Copper kilograms per square foot	Aluminum, inch	Stainless Steel, inch	Terne-Coated Stainless Steel, inch	Zinc-Coated Steel, U.S. Std. Gage
		Building Ex	pansion Joints		•
Cover	16	.032	.015	.015	24
Waterstop-bellows or flanged, U-type.	16	-	.015	.015	-
Covering on minor flat, pitched or curved surfaces	20	.040	.018	.018	-
Downspouts and leaders	16	.032	.015	.015	24
Downspout clips and anchors	-	.040 clip .125 anchor	-	-	-
Downspout straps, 2- inch	48 (a)	.060	.050	-	-
Conductor heads	16	.032	.015	.015	-
Scupper lining	20	.032	.015	.015	-
Strainers, wire diameter or gage	No. 9 gage	.144 diameter	.109 diameter	-	-
Joint cap for building expansion seam, cleated joint at roof	1.25 inch single lock, standing seam, cleated		1.25 inch single lock, standing		-
Flashings					
Base	20	.040	.018	.018	24

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Cap (Counter-	16	.032	.015	.018	5	26
Fave	16		015	014	5	24
Spandrel beam	10	_	.010	.010	ן ר	
Bond barrier	16	_	.010	.010	5	_
Stenned	16	032	.015	.010	5	_
Valley	16	.032	.015	.010	5	_
Poof drain	16 (b)	.032	.015	.01)	_
Ripo vont cloavo (d)	10 (b)	-	-			-
Coning	-	-	-	-		-
Coping Gravel stops and	10	-	-			-
fascia:	-	-	-	-		-
Extrusions	-	.075	-	-		-
Sheets, corrugated	16	.032	.015	.01	5	-
Sheets, smooth	20	.050	.018	.018	3	24
Edge strip	24	.050	.025	-	-	
		Gu	Itters			
Gutter section	16	.032	.015	.015	5	24
Continuous cleat	16	.032	.015	.01	5	24
Hangers dimensions	1 inch by	1 inch by	1 inch by 0	-	-	-
riangere, americiere	1/8 inch (a)	inch (c)	inch			
Joint Cover plates	16	.032	.015	.01	5	24
Reglets (c)	10	-	.010	.010		-
Splash pans	16	.040	.018	.018	3	-
(a) Brass.						
(b) May be lead weighing 4 pounds per square foot.						
(c) May be polyviny	(c) May be polyvinyl chloride.					
(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to						
Base	On	e inch	One inch fla	at locked		Aluminum
Dusc	3 inch lap for expansion		soldered; sealed; 3 inch		manufacturer's	
	joint		lap for expansion joint		recommended hard	
					setting	sealant for locked
					alum	ninum joints. Fill
					each	vith a joint sealing
					joint w	compound.
Cap-in reglet	3 inch lap		3 inch lap		Seal	groove with joint
	' r '		- 1		sea	ling compound.
Reglets	Butt joint				Seal r	eglet groove with
	-				joint se	ealing compound.
Eave	One inch flat locked,		One inch flat locked,		Same	as base flashing.
	cleated. O	ne inch loose	locked, cleated one			
	locked, sealed expansion		inch loose locked,			
	joint,	cieated.	iointe ol	eated		
L	I			Caleu		

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Stepped	3 inch lap	3 inch lap		
Valley	6 inch lap cleated	6 inch lap cleated		
Edge strip	Butt	Butt		
	Grave	el stops		
Extrusions		Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate	
Sheet, smooth	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing backup plate.	
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks	
Sheet, corrugated	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing beneath and a cover plate or a combination unit	
Gutters	1.5 inch lap, riveted and soldered	One inch flat locked riveted and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.	
(a) Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.				
(b) Seal Polyvinyl chloride reglet with manufacturer's recommended sealant.				

END OF SECTION 07 60 00

07 84 00 FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

- A. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- B. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; do not allow firestopping material to interfere with the required movement of the joint.
- C. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E699	Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
ASTM E814-13a	Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E1399/E1399M	Standard Test Method for Cyclic Movement and Measuring the Minimum and
	Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	Standard Test Method for Fire-Resistive Joint Systems
ASTM E2174	Standard Practice for On-Site Inspection of Installed Firestop Systems
ASTM E2307	Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier
	Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and
	Perimeter Fire Barriers
FM GLOBAL (FM)	
FM 4991	Approval of Firestop Contractors

FM APP GUIDE	Approval Guide http://www.approvalguide.com/
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INTERNATIONAL CODE COUNCIL (ICC)

International Building Code

UNDERWRITERS LABORATORIES (UL)

UL 723	UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL 1479	Fire Tests of Through-Penetration Firestops
UL 2079	Tests for Fire Resistance of Building Joint Systems
UL Fire Resistance	Fire Resistance Directory

1.3 SEQUENCING

ICC IBC

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Locate cast-in-place firestop devices and install in place before concrete placement. Install pipe, conduit or cable bundles through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material must be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Shop Drawings
 - 1. Firestopping System
- B. Product Data
 - 1. Firestopping Materials
- C. Test Reports
 - 1. Inspection
- D. Certificates
 - 1. Inspector Qualifications
 - 2. Firestopping Materials
 - 3. Installer Qualifications

1.5 QUALITY ASSURANCE

A. Installer

Engage an experienced Installer who is:

- 1. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or
- 2. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer must be a trained representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. Obtain and submit installer's written certification of training and retain proof of certification for duration of firestop installation.
- B. Inspector Qualifications

The inspector must [meet the criteria contained in ASTM E699 for agencies involved in quality assurance and must] have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector must be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector must not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

PART 2 PRODUCTS

2.1 FIRESTOPPING SYSTEM

Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, submit a manufacturer's engineering judgment, derived from similar UL system designs or other tests for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application. Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

2.2 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

A. Fire Hazard Classification

Provide material that has a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Provide an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

B. Toxicity

Provide material that is nontoxic and carcinogen free to humans at all stages of application or during fire conditions and does not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

C. Fire Resistance Rating

Firestop systems must be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems must also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

1. Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SUMMARY, must provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814-13a or UL 1479. Provide fire resistance ratings as follows:

- a. Penetrations of Fire Resistance Rated Walls and Partitions
 - F Rating = Rating of wall or partition being penetrated.
- b. Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the Ceiling Membrane of Roof-Ceiling Assemblies

F Rating = 2 hour, T Rating = 2 hour. Where the penetrating item is outside of a wall cavity the F rating must be equal to the fire resistance rating of the floor penetrated, and the T rating must be in accordance with the requirements of ICC IBC.

c. Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies

F Rating = 2 hour, T Rating = 2 hour and L Rating = <10 cfm/sf Where L rating is required.

2. Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SUMMARY, and gaps such as those between floor slabs and curtain walls must be the same as the construction in which they occur. Provide construction joints and gaps with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Provide curtain wall joints with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints must meet the cycling requirements of ASTM E1399/E1399M or UL 2079. Provide a minimum class II movement capability for all joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly.

D. Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. Provide certification of compliance with UL 1479 for all intumescent firestop materials used in through penetration systems.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

A. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

- B. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- C. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- D. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- E. Construction joints in floors and fire rated walls and partitions.
- F. Other locations where required to maintain fire resistance rating of the construction.
- G. Insulated Pipes and Ducts

Cut and remove thermal insulation where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

H. Fire Dampers

Install and firestop fire dampers in accordance with Section 23 30 00 HVAC AIR DISTRIBUTION. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

I. Data and Communication Cabling

Seal cabling for data and communication applications with re-enterable firestopping [products] [devices] [products and devices as indicated].

1. Re-Enterable Devices

Provide firestopping devices that are pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf [measured at ambient temperature and 400 degrees F] at 0 percent to 100 percent visual fill.

2. Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Allow for cable moves, additions or changes. Provide devices capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

3.3 INSPECTION

For all projects, do not cover or enclose the firestopped areas until inspection is complete and approved by the Project Manager. The Project Manager must inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL listed printed numbers.

A. Inspection Standards

Inspect all firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results to be submitted.

B. Inspection Reports

Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

-- End of Section 07 84 00--

SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:
- B. This Section includes sealants for the following applications:
 - 1. Exterior joints in the following vertical surfaces and non-traffic horizontal surfaces:
 - a. Control and expansion joints in masonry.
 - b. Perimeter joints between materials listed above and frames of doors and windows.
 - c. Joints between dissimilar materials.
 - d. Other joints as indicated.
 - e. Imperfect joints as requested by the architect.
 - Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
 a. Perimeter joints of exterior openings where indicated.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and waterresistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):

C509-06Elastomeric Cellular Preformed Gasket and Sealing Material
C612-14Mineral Fiber Block and Board Thermal Insulation
C717-14aStandard Terminology of Building Seals and Sealants
C734-06(R2012)Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering
C794-10Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
C919-12Use of Sealants in Acoustical Applications.
C920-14aElastomeric Joint Sealants.
C1021-08(R2014)Laboratories Engaged in Testing of Building Sealants
C1193-13Standard Guide for Use of Joint Sealants.
C1248-08(R2012) Test Method for Staining of Porous Substrate by Joint Sealants
C1330-02(R2013)Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
C1521-13Standard Practice for Evaluating Adhesion of Installed
Weatherproofing Sealant Joints
D217-10Test Methods for Cone Penetration of Lubricating Grease
D1056-14Specification for Flexible Cellular Materials—Sponge or
Expanded Rubber
E84-09Surface Burning Characteristics of Building Materials
Sealant, Waterproofing and Restoration Institute (SWRI). The Professionals' Guide

- D. Environmental Protection Agency (EPA):
 - 40 CFR 59(2014)National Volatile Organic Compound Emission Standards for Consumer and Commercial Products
- 1.4 DELIVERY, STORAGE, AND HANDLING

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- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, *and* multi-component material mixing instructions.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Do not subject to sustained temperatures exceeding 90 degrees F or less than 40 degrees F.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - b. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
 - c. When joint substrates are wet.
- B. Joint-Width Conditions:
 - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
 - 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.
- 1.6 WARRANTY
 - A. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within two (2) years from date of Substantial Completion.
- PART 2 PRODUCTS
- 2.1 PRODUCTS AND MANUFACTURERS
 - A. Products: Subject to compliance with requirements, provide type.

2.2 SEALANTS:

- A. Exterior Sealants:
 - 1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
 - 2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25.
 - 3. Provide location(s) of exterior sealant as follows:
 - a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
 - b. Metal to metal.
 - c. Masonry to masonry or stone.
 - d. Stone to stone.
 - e. Cast stone to cast stone.
 - f. Masonry expansion and control joints.
 - g. Wood to masonry.
 - h. Masonry joints where shelf angles occur.
 - i. Voids where items penetrate exterior walls.
 - j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is
 - penetrated by coping dowels.
- B. Floor Joint Sealant:
 - 1. ASTM C920, Type S or M, Grade P, Class 25, Use T.

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- 2. Provide location(s) of floor joint sealant as follows.
 - a. Seats of metal thresholds exterior doors.
 - b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.
- C. Interior Sealants:
 - 1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
 - 2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
 - 3. Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.
 - 4. Provide location(s) of interior sealant as follows:
 - a. Typical narrow joint 1/4 inch or less at walls and adjacent components.
 - b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
 - c. Interior surfaces of exterior wall penetrations.
 - d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
 - e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
 - f. Exposed isolation joints at top of full height walls.
 - g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
 - h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
 - i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.
- D. Acoustical Sealant:
 - Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
 - 2. Provide location(s) of acoustical sealant as follows:
 - a. Exposed acoustical joint at sound rated partitions.
 - b. Concealed acoustic joints at sound rated partitions.
 - c. Joints where item pass-through sound rated partitions.

2.3 COLOR:

- A. Sealants used with exposed masonry are to match color of mortar joints.
- B. Sealants used with unpainted concrete are to match color of adjacent concrete.
- C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.4 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and

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capable of remaining resilient at temperatures down to minus 26 degrees F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 WEEPS:

- A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.
 - 1. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch OD by thickness of stone or masonry veneer.

2.6 FILLER:

- A. Mineral fiberboard: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.7 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.8 CLEANERS-NON POROUS SURFACES:

A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.

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- 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
 - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 - 2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

- A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.
- D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- 3.4 SEALANT DEPTHS AND GEOMETRY:
 - A. At widths up to 1/4 inch, sealant depth equal to width.
 - B. At widths over 1/4 inch, sealant depth 1/2 of width up to 1/2 inch maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

- A. General:
 - 1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
 - 2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 - 3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
 - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
 - 5. Avoid dropping or smearing compound on adjacent surfaces.
 - 6. Fill joints solidly with compound and finish compound smooth.
 - 7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.

SECTION 07 92 00 JOINT SEALANTS

- 8. Finish paving or floor joints flush unless joint is otherwise detailed.
- 9. Apply compounds with nozzle size to fit joint width.
- 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
- 11. Replace sealant which is damaged during construction process.
- B. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
 - 1. Use round plastic tubing to form weep holes.
 - 2. Space weep holes formed from plastic tubing not more than 16 inches o.c.
 - 3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.
- C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.
- D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
 - 1. Apply a 1/4 inch minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
 - 2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
 - 3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
 - 4. Openings: Apply a 1/4 inch bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
 - 5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 92 00

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Standard and custom hollow metal doors and frames.
- 2. Steel sidelight, borrowed lite and transom frames.
- 3. Louvers installed in hollow metal doors
- 4. Light frames and glazing installed in hollow metal doors.
- B. Related Sections:
 - 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Clad Wood Doors".
 - 4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
 - 5. Division 08 Section "Door Hardware".
 - 6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 2. ANSI A250.8 Recommended Specifications for Standard Steel Doors and Frames.
 - 3. ANSI/NAAMM HMMA 801 Glossary of Terms for Hollow Metal Doors and Frames.
 - 4. NAAMM HMMA 802 Manufacturing of Hollow Metal Doors and Frames.
 - 5. NAAMM HMMA 803 Steel Tables.
 - 6. NAAMM HMMA 810 Hollow Metal Doors.
 - 7. NAAMM HMMA 810 TN01 Defining Undercuts.
 - 8. NAAMM HMMA 820 Hollow Metal Frames.
 - 9. NAAMM HMMA 820 TN01 Grouting Hollow Metal Frames.
 - 10. NAAMM HMMA 820 TN02 Continuously Welded Frames.
 - 11. NAAMM HMMA 831 Recommended Hardware Locations for Hollow Metal Doors and Frames.
 - 12. NAAMM HMMA 840 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames.
 - 13. ANSI/NAAMM HMMA 841 Tolerances and Clearances for Commercial Hollow Metal Doors and Frames.
 - 14. ASTM A1008 Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 15. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 16. ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 17. ANSI/BHMA A156.15 Hardware Preparation in Steel Doors and Frames.
 - 18. ANSI/NFPA 80 Standard for Fire Doors and Fire Windows; National Fire Protection Association.

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

- 19. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
- 20. NFPA 252 Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
- 21. UL 10C Positive Pressure Fire Tests of Door Assemblies.
- 22. UL 1784 Standard for Air Leakage Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: Meet fabrication and quality standards set by the Hollow Metal Manufacturers Association, HMMA, as set forth in the contract documents and NAAMM HMMA standards 800 through 860 series.
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

1.6 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Curries Company.

2.2 MATERIALS

- A. Metallic-Coated Steel Sheet: tension level steel to ASTM A924, galvanized to ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating known commercially as paintable Galvanneal.
- B. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI A250.8.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard polyurethane. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 3.2 or better.
 - 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 4. Hinge Reinforcement: Minimum 10 gauge plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 5. Hardware Reinforcements: Fabricate according to ANSI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical performance level:
 - 1. Design: Flush panel.

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- Core Construction: Honeycomb Structural small cell (1" (25.4mm) maximum) kraft paper. Weight: 80 lb. (36.3kg) per ream minimum. Density: 1.03 pcf (16.5kg/m³) minimum, sanded to the required thickness.
- 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch 1.0-mm) thick steel, Model 2.
- 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
- 5. Hinge Reinforcement: Minimum 10 gauge plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
- 6. Hardware Reinforcements: Fabricate according to ANSI A250.6 with reinforcing plates from same material as door face sheets.

2.4 ENERGY EFFICIENCY HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Energy Efficiency Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model, ANSI A250.4 for physical performance level, and HMMA 867 for door construction.
 - 1. Design: Flush panel.
 - 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" oncenter to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.29 and R-Value 3.4, including insulated door, thermal-break frame and threshold.
 - 3. Level/Model: Level 2 and Physical Performance Level A (Heavy Duty), Minimum 18 gauge (0.042 inch 1.1-mm) thick steel, Model 2.
 - 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 7 gauge plate 1-1/4" x 9".
 - 7. Hardware Reinforcements: Fabricate according to ANSI A250.6 with reinforcing plates from same material as door face sheets.
- C. Manufacturers Basis of Design:
 - 1. Fleming Trio-E/Trio Series.

2.5 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40.
 - 1. Fabricate frames with mitered or coped corners.

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- 2. Fabricate frames, with the exception of knock down types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
- 3. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
- 4. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 12 gauge (0.081inch -2.7-mm) thick steel sheet.
- 5. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
- 6. Manufacturers Basis of Design:
 - a. Fleming F Series/F Series SR.
- C. Interior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
 - 3. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 4. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.]
 - 5. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 14 gauge (0.067inch -1.7-mm) thick steel sheet.]
 - 6. Frames for Wood Doors: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
 - 7. Frames for Borrowed Lights: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
 - 8. Manufacturers Basis of Design:
 - a. Fleming DW/DW CO/DW SR Series (Drywall Profile).
 - b. Fleming F Series/F Series SR (Masonry Profile).
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 FRAME ANCHORS

A. Jamb Anchors:

- 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A40 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
- 2. Stud Wall Type: Designed to engauge stud and not less than 0.042 inch thick.
- 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A40 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.7 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.8 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

- 1. Blade Type: Vision proof inverted V or inverted Y.
- 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.9 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.
- E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.
 - 1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.10 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.11 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM 841.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fireperformance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

- 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 - 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 - 8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 - 10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI A250.8.
 - 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

- 3. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
- 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.12 STEEL FINISHES

A. Remove weld slag and spatter from exposed surfaces. All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth and uniform surfaces. On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up primer. Primer shall be fully cured prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with NAAMM/HMMA 840 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

- b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
- c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
- d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer.

END OF SECTION 08 11 13

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

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SECTION 08 14 16 FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core flush wood doors with plastic-laminate-faces.

1.3 ACTION SUBMITTALS

- A. Confirmation of compliance with Build America, Buy America Act.
- B. Product Data: For each type of product, including the following:
 - 1. Door core materials and construction.
 - a. Door cores must have a minimum recycled content of 45 percent. Provide data identifying percentage of recycled content. Product must contain no added unraformaldehyde resins.
 - 2. Door edge construction
 - 3. Door face type and characteristics.
 - 4. Door trim for openings.
 - 5. Door frame construction.
 - 6. Factory-machining criteria.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Details of frame for each frame type, including dimensions and profile.
 - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 5. Dimensions and locations of blocking for hardware attachment.
 - 6. Dimensions and locations of mortises and holes for hardware.
 - 7. Clearances and undercuts.
- D. Samples for Initial Selection: For plastic-laminate door faces.
- E. Samples for Verification:
 - 1. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

SECTION 08 14 16 FLUSH WOOD DOORS

- a. Delamination of veneer.
- b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
- c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
- 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors and frames.
- 3. Warranty Period for Solid-Core Interior Doors: Life of installation.
- 4. Warranty Period for Hollow-Core Interior Doors: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

- A. Interior Doors:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - a. VT Industries Inc.
 - 2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
 - 3. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
 - 4. Colors, Patterns, and Finishes: Finish as selected by architect from manufacturers full line of finishes.
 - 5. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
 - 6. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-1 or LD-2 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-compositelumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."
 - 7. Construction: Five plies, hot-pressed or cold-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces and crossbands are applied.

2.3 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 - 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.

SECTION 08 14 16 FLUSH WOOD DOORS

- 1. Light Openings: Trim openings with moldings of material and profile indicated.
- 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

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

3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
 - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

3.3 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- C. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

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

END OF SECTION 08 14 16

SECTION 08 14 16 FLUSH WOOD DOORS

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SECTION 08 31 13 ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.
- 1.3 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Certification of compliance with Build America, Buy America Act.
- B. Qualification Data: For testing and inspecting agency.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
- 1.5 CLOSEOUT SUBMITTALS
 - A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.
- 1.6 QUALITY ASSURANCE
 - A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of firerated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges
 - 1. <u>Manufacturers:</u> 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. <u>Babcock-Davis</u>.
 - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - c. Larsen's Manufacturing Company.
 - d. <u>Nystrom, Inc</u>.
 - Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 3. Locations: Wall and ceiling .TBD
 - 4. Door Size: 24" X 24" Provide 10 each location TBD.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage factory primed.
 - 6. Frame Material: Same material, thickness, and finish as door, thickness, and finish.
 - 7. Latch and Lock: Cam latch, screwdriver operated

2.

SECTION 08 31 13 ACCESS DOORS AND FRAMES

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- Fire-Rated, Flush Access Doors with Exposed Flanges :
 - 1. <u>Manufacturers:</u> 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. <u>Babcock-Davis</u>.
 - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - c. Larsen's Manufacturing Company.
 - d. <u>Nystrom, Inc</u>.
 - 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal with exposed flange, self-closing door, and concealed hinge.
 - 3. Locations: Wall and ceiling Location TBD.
 - 4. Door Size: 24" X 24" Provide 6 each location TBD.
 - 5. Fire-Resistance Rating: Not less than that indicated.
 - 6. Temperature-Rise Rating: 250 deg F at the end of 30 minutes.
 - 7. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage factory primed.
 - 8. Frame Material: Same material, thickness, and finish as door, .
 - 9. Latch and Lock: Self-latching door hardware, operated by knurled-knob with interior release.

2.4 MATERIALS

Α.

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 - 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinccoated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
 - 1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

SECTION 08 31 13 ACCESS DOORS AND FRAMES

- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 31 13 ACCESS DOORS AND FRAMES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Swinging doors.
 - 2. Sliding doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Clad Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC International Building Code.
 - 3. NFPA 70 National Electrical Code.
 - 4. NFPA 80 Fire Doors and Windows.
 - 5. NFPA 101 Life Safety Code.
 - 6. NFPA 105 Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards A156 Series.
 - 2. UL10C Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 Access Control System Units.
 - 4. UL 305 Panic Hardware.
 - 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3.

SECTION 08 71 00 DOOR HARDWARE

Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

- 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
- 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to Arrow. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded Arrow.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.

- b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
- 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
- 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
- 5. Manufacturers:
 - a. McKinney (MK) TA/T4A Series, 5 knuckle.

2.3 SLIDING AND FOLDING HARDWARE

- A. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.
 - 1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
 - 2. Cascading: Provide a bi-parting or single direction telescoping system as required with a minimum 200 lb. per door capacity.
 - 3. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.
 - 4. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
 - 5. Manufacturers:
 - a. Pemko (PE).

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Manufacturers:
 - a. Rockwood (RO).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 - 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

- 6. Manufacturers:
 - a. Rockwood (RO).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
 - Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide temporary keyed construction cores.
- F. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) ML2000 Series.
 - b. Sargent Manufacturing (SA) 8200 Series.
- 2.7 DOOR CLOSERS
 - A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of

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use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

- 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
- 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
- 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
 - 1. Heavy duty surface mounted door closers shall have a 30-year warranty.
 - 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) DC6000 Series.
 - b. Norton Rixson (NO) 7500 Series.
 - c. Sargent Manufacturing (SA) 351 Series.

2.8 ARCHITECTURAL TRIM

- A. Door Protective Trim
 - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
 - 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
 - 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
 - 4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
 - 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
 - 6. Manufacturers:
 - a. Rockwood (RO).

2.9 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Manufacturers:
 - a. Rockwood (RO).

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- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Manufacturers:
 - a. Rockwood (RO).

2.10 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).

2.11 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 - 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Manufacturer's Abbreviations:
 - 1. MK McKinney
 - 2. PE Pemko
 - 3. RO Rockwood
 - 4. RU Corbin Russwin
 - 5. ET Emtek
 - 6. DO dormakaba Arch Hdw
 - 7. RF Rixson
 - 8. NO Norton

Hardware Sets

Set: 1.0

Doors: 201B, 205B Description: EXT PR - Entry

 6 Hinge, Full Mortise 1 Flush Bolt 1 Dust Proof Strike 1 Apartment Lock 2 Door Stop 1 Threshold 1 Gasketing 1 Rain Guard 2 Sweep 1 Astragal set 	TA2314 NRP 555 [12" / 72" AFF] 570 ML2067 NSA 467 2005AT MSES25SS 303AS 346C x LAR 3452AV 18061CNB	US32D US26D US26D 626 Black	MK RO RU PE PE PE PE
<u>Set: 2.0</u> Doors: 208 Description: SGL - RATED Storeroom			
 3 Hinge, Full Mortise 1 Storeroom Lock 1 Surface Closer 1 Kick Plate 1 Door Stop 1 Gasketing 	TA2714 ML2057 NSA 7500 Arm As Required K1050 10" X 2" LDW 409 / 446 as required S88D	US26D 626 689 US32D US26D	MK RU NO RO RO PE
<u>Set: 3.0</u> Doors: 203 Description: SGL - RATED - PRIVACY			
 3 Hinge, Full Mortise 1 Privacy Lock 1 Surface Closer 1 Mop Plate 1 Kick Plate 1 Door Stop 1 Gasketing 	TA2714 ML2060 NSA 7500 Arm As Required K1050 4" X 1" LDW K1050 10" X 2" LDW 409 / 446 as required S88D	US26D 626 689 US32D US32D US26D	MK RU NO RO RO PE
<u>Set: 4.0</u> Doors: 206 Description: SGL - PASSAGE			
3 Hinge, Full Mortise1 Passage Latch1 Kick Plate1 Door Stop	TA2714 ML2010 NSA K1050 10" X 2" LDW	US26D 626 US32D	MK RU RO

<u>Set: 5.0</u> Doors: 204

Description: SGL - LOCK - STOR

 Hinge, Full Mortise Storeroom Lock Door Stop Silencer 	TA2714 ML2057 NSA 409 / 446 as required 608	US26D 626 US26D	MK RU RO RO
<u>Set: 6.0</u> Doors: 104, 207 Description: SGL - Privacy			
3 Hinge, Full Mortise1 Privacy Lock1 Mop Plate1 Door Stop1 Gasketing	TA2714 ML2060 NSA K1050 4" X 1" LDW 409 / 446 as required S88D	US26D 626 US32D US26D	MK RU RO RO PE
<u>Set: 7.0</u> Doors: 103 Description: SGL - PASS			
3 Hinge, Full Mortise1 Passage Latch1 Door Stop3 Silencer	TA2714 ML2010 NSA 409 / 446 as required 608	US26D 626 US26D	MK RU RO RO
<u>Set: 8.0</u> Doors: 200 Description: SGL - LOCK - PASS	[OHS]		
3 Hinge, Full Mortise1 Passage Latch1 Surf Overhead Stop3 Silencer	TA2714 ML2010 NSA 10-X36 608	US26D 626 689	MK RU RF RO
<u>Set: 9.0</u> Doors: 202 Description: Bi-Folding - 2 Panel			
 Sliding Door Hdwe Flush Pull 	HF2/100A RM785	US26D	PE RO
<u>Set: 10.0</u> Doors: 106 Description: Bi-Folding - 4 Panel			
 Sliding Door Hdwe Flush Pull 	HF4/100A/4 RM785	US26D	PE RO
<u>Set: 11.0</u> Doors: 101 Description: EXT EAC Lock			
 3 Hinge, Full Mortise 1 Electric Lock 1 Surface Closer 	TA2314 NRP Oracode 660 7500 Arm As Required	US32D 689	MK DO NO
TSP, Inc. ©	08 71 00 - 12/14 CONSTRUCTION DOCUMENTS		03

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 Door Stop Threshold Gasketing 	409 / 446 as required 271A MSES25SS 303AS	US26D	RO PE PE
Set: 12.0 Doors: 105A, 201A, 205A Description: INT EAC Lock - Rated			
3 Hinge, Full Mortise1 Electric Lock1 Surface Closer1 Door Stop1 Gasketing	TA2714 Oracode 660 7500 Arm As Required 409 / 446 as required S88D	US26D 689 US26D	MK DO NO RO PE
<u>Set: 13.0</u> Doors: 105B Description: POCKET - PRIVACY			
 Pocket Door Hdwe Pocket door latch (Privacy) 	PF28200A 2185 <u>END OF SECTION 08 71 00</u>		PE ET

SECTION 08 71 00 DOOR HARDWARE

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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. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Adhesives.
 - 4. Corner/Edge Trim.
 - 5. Finishing Materials.
- B. Related Sections:
 - 1. 09 91 23 "Interior Painting"

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Certification of compliance with Build America, Buy America Act.
- C. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. <u>Manufacturers:</u> 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. <u>CertainTeed Corporation</u>.
- b. National Gypsum Company.
- c. United States Gypsum Company.
- 2. Thickness: 5/8 inch (15.9 mm).
- 3. Long Edges: Tapered.

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- Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. <u>Manufacturers:</u> 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. <u>CertainTeed Corporation</u>.
 - b. National Gypsum Company.
 - c. United States Gypsum Company.
 - 2. Thickness: 5/8 inch (15.9 mm).
 - 3. Long Edges: Tapered.
- C. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. <u>Manufacturers:</u> 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. <u>CertainTeed Corporation</u>.
 - b. <u>National Gypsum Company</u>.
 - c. <u>United States Gypsum Company</u>.
 - 2. Core: As indicated.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. <u>Manufacturers:</u> 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. <u>CertainTeed Corporation</u>.
 - b. National Gypsum Company.
 - c. United States Gypsum Company.
 - 2. Thickness: 1/2 inch (12.7 mm).
 - 3. Long Edges: Tapered.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
 - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. <u>CertainTeed Corporation;</u> FiberCement BackerBoard
 - b. James Hardie Building Products, Inc.; Hardiebacker.
 - c. <u>National Gypsum Company</u>; PermaBase BRAND Cement Board.
 - d. United States Gypsum Company; DUROCK Cement Board
 - 2. Thickness: 5/8 inch (15.9 mm).
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 BULLET RESISTANT FIBERGLASS PANELS

- A. Fiberglass Panels: Complying with UL 752 Ballistic Performance requirements tests as well as all bullet resistant test requirements set forth by the National Institute of Justice.
 - 1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. CR Laurence (1-800-421-6144).
 - b. Architect approved equal.

- B. Bullet Resistant Type:
 - 1. 3 S.P.S.A. as Laurence catalog # BRF 300.
 - 2. Thickness: 7/16 inch (11.1 mm).
 - 3. Panel Size: 96 inch x 48 inch (2.44 m x 1.22 m).

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. <u>Pecora Corporation;</u> AC-20 FTR.

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- b. <u>Specified Technologies, Inc.;</u> Smoke N Sound Acoustical Sealant.
- c. <u>United States Gypsum Company</u>; SHEETROCK Acoustical Sealant.
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
 - C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

- 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
- 2. Type X: Where required for fire-resistance-rated assembly.
- 3. Ceiling Type: Ceiling surfaces.
- 4. Mold-Resistant Type: Toilet rooms, and other areas where moisture and humidity are present.

- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use at exposed panel edges where indicated.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

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- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 13 CERAMIC TILING

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. Porcelain tile.
 - 2. Glazed wall tile.
 - 3. Tile backing panels Waterproof membrane.
 - 4. Metal edge strips.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- A. Face Size: Actual tile size, excluding spacer lugs.
- B. Module Size: Actual tile size plus joint width indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
 - 4. Stone thresholds in 6-inch lengths.
 - 5. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.
- E. Certification of Compliance with the Build America Buy America Act

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1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
- 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
- 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
- 3. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.
- 4. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- 1.9 FIELD CONDITIONS
 - A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Stone thresholds.
 - 2. Waterproof membrane.
 - 3. Crack isolation membrane.
 - 4. Cementitious backer units.
 - 5. Metal edge strips.

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2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 TILE PRODUCTS

A. Ceramic Tile Porcelain Tile CT1: Factory-mounted unglazed.

- 1. Composition: Porcelain Retain "Certification" Subparagraph below if applicable. Not all tile that is called "porcelain" complies with requirements of ANSI A137.1 for porcelain tile. The Porcelain Tile Certification Agency is a joint effort of the Ceramic Tile Distributors Association and TCNA to verify the properties of tile that is advertised as porcelain.
- 2. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
- 3. Module Size: 12" x 24"
- 4. Thickness: 5/16 inch
- 5. Face: Plain
- 6. Surface: Smooth Slip resistant, with] abrasive admixture.
- 7. Dynamic Coefficient of Friction: Not less than 0.42.
- 8. Tile Color and Pattern: Alpine White color. Pattern: laid in brick lay pattern. Can refer to finish schedule for pattern indicated.
- 9. Grout Color: 5047 Charcoal If trim units do not match adjoining flat tile, copy and re-edit "Trim Units" Subparagraph below separately for trim units, deleting option.
- 10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Floor Bullnose: Number: P-43C9 Size: 3x12
 - b. Cove Base: Number: P-36C9T Size: 6 x 12
 - c. Cove Base Outcorner Number: PC-36C9T Size: 1x6
 - 1) Cove base trim is intended to coordinate with floor tile in the stand 90 degree installation position.
- 11. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
- 12. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.
- B. Ceramic Tile Type CT2: Glazed square-edged quarry tile.
 - 1. Face Size: 3 inch x 12 inch
 - 2. Thickness: 5/16" (8MM) Wearing Surface: Nonabrasive, smooth.
 - 3. Dynamic Coefficient of Friction: Not less than 0.42.
 - 4. Tile Color and Pattern:
 - a. Color: Balance Pattern: Will be laid in stacked pattern look.
 - 5. Grout Color: 5027 Silver Mapei
 - 6. Ceramic Tile Type
 - 7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Bullnose Matte: 3" x 12"

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- b. Cove Base Matte: 6" x 12"
- c. Mosaic 2" x 2" Matte-Raw 12" x 12" 36 DOT
- C. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as used for adjoining wall tile.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 - 1. <u>Products: Subject to compliance with requirements, available products that may be incorporated into the work include/, but are not limited to the following:</u>
 - a. CertainTeed Corp.; Fiber Cement BackerBoard.
 - b. James Hardie Building Projects, Inc. Hardiebacker.
 - c. National Gypsum Company, Permabase Cement Board.
 - d. USG Corporation, DUROCK Cement Board.
 - 2. Thickness: 5/8 inch (15.9 mm).
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274

2.6 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
- 2.7 CRACK ISOLATION MEMBRANE
 - A. General: Manufacturer's standard product selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 - B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 - 1. Products: Subject to compliance with requirements, provide one of the following or approved equal:
 - a. TEC; a subsidiary of H. B. Fuller Company; HydraFlex Waterproofing Crack Isolation Membrane.
 - b. Laticrete International, Inc.; Hydro Ban.

2.8 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - 1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
 - 2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
 - 3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C847.
 - a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.

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- c. Configuration over Studs and Furring: Flat.
- d. Configuration over Solid Surfaces: Self-furring.
- e. Weight: 2.5 lb/sq. yd.
- 4. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed Portland cement and aggregate mortar bed.
- B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 - 1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

2.9 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.11 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with adhesives bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

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- 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
- 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile swimming pool decks.
 - d. Tile floors in laundries.
 - e. Tile floors consisting of tiles 8 by 8 inches or larger.
 - f. Tile floors consisting of rib-backed tiles.
 - B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 - C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 - D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
 - E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
 - F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
 - Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Glazed Wall Tile: 1/8 inch.
 - 2. Porcelain Tile: 1/4 inch.

G.

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- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Metal Edge Strips: Install at locations indicated.
- J. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INSTALLATION OF TILE BACKING PANEL

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 INSTALLATION OF WATERPROOF MEMBRANE

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 INSTALLATION OF CRACK ISOLATION MEMBRANE

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Wood Subfloor:
 - a. Ceramic Tile Type: CT1
 - b. Grout: High-performance sanded.
 - c. Ceramic Tile Type: CT2
 - d. Grout: High-performance unsanded.

END OF SECTION 09 30 13

DIVISION 09 - FINISHES

SECTION 09 30 13 CERAMIC TILING

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SECTION 09 65 13 RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
- B. Rubber molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Certification of Compliance with the Build American Buy America Act
- D. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- E. Samples for Initial Selection: For each type of product indicated.
- F. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- G. Product Schedule: For resilient base and accessory products. RSTA.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 70 deg F or more than 80 deg F.
- B. Deliver products in manufacturer's original sealed packaging.
- C. Mark packaging legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacturer's date/
- D. Before installation, return or dispose or products within distorted, damaged or opened packaging.
- E. Protect products from damage when handling and during construction operations.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F > or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.
- D. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

SECTION 09 65 13 RESILIENT BASE AND ACCESSORIES

PART 2 - PRODUCTS

D.

- A. Provide each product from one manufacturer and from one production run.
- B. Provide resilient stair treads and sheet rubber flooring from same manufacturer.

2.2 RUBBER MOLDING ACCESSORY - RSTA

- A. Basis of Design: Mannington Commercial, Nosing, 575 Overlap Stair Nosing Light Beige 206 (
- B. Description: Rubber stair-tread nosing
- C. Profile and Dimensions: 12'

575 Overlap Stair Nosing Nosing with deep grooves and overlap lip. Accepts material to 1/8" with lip, to 3/16" without lip. *Packing: 10-12' secs., 120 lin. ft. per carton*



- E. Locations: Provide rubber molding accessories on stairs. See drawing for further information.
- F. Colors and Patterns: As indicated by manufacturer's designations: Light Beige 206 Color 575 Overlap Stair Nosing

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Examine and verify substrate suitability for product installation.
- C. Protect existing construction and completed work from damage.
- D. Remove existing base, stair treads, and/or landing flooring to permit new installation.
 - 1. Dispose of removed materials.
- E. Correct substrate deficiencies.
 - 1. Fill cracks, pits, and depressions with leveling compound.
 - 2. Remove protrusions; grind high spots.
 - 3. Apply leveling compound to achieve 1/8 inch in 10 feet maximum surface variation.
- F. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
 - 1. Mechanically clean concrete floor substrate according to ASTM D4259.
 - 2. Surface Profile: ICRI Guideline No. 310.2R.
- G. Allow substrate to dry and cure.
- H. Perform flooring manufacturer's recommended bond, substrate moisture content, and pH tests.

SECTION 09 65 13 RESILIENT BASE AND ACCESSORIES

- I. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- J. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- K. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.
- L. INSTALLATION GENERAL
- M. Install products according to manufacturer's instructions.
 - 1. When instructions deviate from specifications, submit proposed resolution for Contracting Officer consideration.
- 3.3 RESILIENT STAIR TREAD INSTALLATION
 - A. Install resilient stair treads without joints on each stair tread substrate.
 - 1. Install full width resilient stair treads on each intermediate and floor landing.
 - B. Apply adhesive uniformly for full contact between resilient stair tread and substrate.
 - 1. Roll resilient stair treads ensuring complete adhesion.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
 - 4. Clean with mild detergent. Leave surfaces free of detergent residue.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.
- E. Prohibit traffic on resilient stair treads and sheet rubber flooring 72 hours minimum after installation.
- F. Cover resilient stair trends and sheet rubber flooring with reinforced kraft paper and plywood or hardboard.
- G. Maintain protection until directed by contracting officer's presentative.
- H. Replace damaged products and re-clean.
 - 1. Damaged Products include cut, gouged, scraped, torn, and unbonded products. END OF SECTION 09 65 13

SECTION 09 65 13 RESILIENT BASE AND ACCESSORIES

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SECTION 09 65 19 RESILIENT TILE FLOORING

PART 1 - GENERAL

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

1.2 SUMMARY

E.

- A. Section Includes:
 - 1. Vinyl composition floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- D. Samples for Initial Selection: For each type of floor tile indicated.
 - Samples for Verification: Full-size units of each color and pattern of floor tile required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than long, of each color required.
- F. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg For more than 95 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.

SECTION 09 65 19 RESILIENT TILE FLOORING

- 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg For more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE LVP1

- A. Basis of Design: Mannington Commercial, Spacia Windsor Oak Golden
- B. Thickness: .098 " (2.5mm)
- C. Size:. 6" x 36"
- D. Colors and Patterns: LVP1 Windsor Oak Golden

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

а

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

SECTION 09 65 19 RESILIENT TILE FLOORING

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis Stagger LVP joints to evenly distribute flooring to provide a natural look. Refer to finish floor plan for how tiles should be layed.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction. Wood Strip pattern built-in items are required to be set on top of floor tile, indicate on Drawings and revise first paragraph below.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 65 19 RESILIENT TILE FLOORING

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SECTION 09 68 13 TILE CARPETING

PART 1 - GENERAL

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

1.2 SUMMARY

A. Section includes modular, tufted

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
 - 3. Certification of compliance with the Build America, Buy America Act
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of installation.
 - 4. Pattern of installation.
 - 5. Pattern type, location, and direction.
 - 6. Type, color, and location of insets and borders.
 - 7. Type, color, and location of edge, transition, and other accessory strips.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

SECTION 09 68 13 TILE CARPETING

- 1.8 DELIVERY, STORAGE, AND HANDLING
 - A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 CARPET TILE CPT1
 - A. Products: Subject to compliance with requirements, provide the following:
 1. Mohawk Group Digital Terrain GT341 Expedition or CPT1
 - B. Color: Sulpher
 - C. Pattern Digital Terrain
 - D. Fiber Type: Duracolor Tricor Premium Nylon with Metaliic Duracolor
 - E. Density: 8571
 - F.
 - G. Stitches: 10.5
 - H. Gage: 1/12 (47.00 rows per 10 cm)
 - I. Surface Pile Weight: 20.00 oz/yd2
 - J. Total Weight: 20.00 oz/yd2 for finished carpet tile.
 - K. Primary Backing/Backcoating: EcoFlex ONE
 - L. Backing System: EcoFlex ONE
 - M. Size: 12" x 36"
 - N. Applied Soil-Resistance Treatment: EcoSentry Soil Protection

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesives 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."

SECTION 09 68 13 TILE CARPETING

C. Transition Strips: Extrudedfinish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. For wood subfloors, verify the following:
 - 1. Underlayment over subfloor complies with requirements specified in Section 06 10 00 "Rough Carpentry."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.
- H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

- 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
- 2. Remove yarns that protrude from carpet tile surface.

SECTION 09 68 13 TILE CARPETING

- 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Gypsum board.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Certification of compliance with the Building America, Buy America Act.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat. Color and gloss of Samples change as they age; seven-day old Samples appear different from freshly dried Samples.
 - 1. Label each coat of each Sample.
 - 2. Label each Sample for location and application area.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Paint: 5percent, but not less than 1 gal. of each material and color applied.
 - 1. Paint: Spercent, but not less than 1 gai. of each material and color app

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

CMU Substrates:

Α.

- 1. High-Performance Architectural Latex System MPI INT 4.2D:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss
 - e. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.
- B. Gypsum Board Substrates:

1.

- High-Performance Architectural Latex System MPI INT 9.2B:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

END OF SECTION 09 91 23

SECTION 09 93 00 STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:
 - 1. Interior Substrates:
 - a. Dressed lumber (finish carpentry or woodwork).
 - b. Wood-based panel products.
 - c. Wood floors and stairs.
- B. Related Requirements:

1. Section 09 91 23 "Interior Painting" for stains and transparent finishes on concrete floors.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of product.
- C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
 - 1. Submit Samples on representative samples of actual wood substrates, 8 inches square
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
- E. Certification of Compliance with the Build America Buy America Act

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials,] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.
- 1.6 QUALITY ASSURANCE
 - A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

SECTION 09 93 00 STAINING AND TRANSPARENT FINISHING

- 1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
- 2. Final approval of stain color selections will be based on mockups.
 - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product listed in wood finish systems schedules for the product category indicated.

2.2 MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Stain Colors: Mulberry MW 473 to be applied to all base trim and interior railing

2.3 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:

- 1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
- 2. Testing agency will perform tests for compliance with product requirements.
- 3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

SECTION 09 93 00 STAINING AND TRANSPARENT FINISHING

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Interior Wood Substrates: 9 percent, when measured with an electronic moisture meter.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with finish application only after unsatisfactory conditions have been corrected.
 - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Interior Wood Substrates:
 - 1. Scrape and clean knots and apply coat of knot sealer before applying primer.
 - 2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
 - 3. Sand surfaces exposed to view and dust off.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.
- 3.3 APPLICATION
 - A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for finish and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

SECTION 09 93 00 STAINING AND TRANSPARENT FINISHING

- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.
- 3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE
 - A. Wood Substrates: Wood trim, architectural woodwork, doors, windows
 - 1. Semitransparent Stain System MPI INT 6.3C:
 - a. Prime Coat: Stain, exterior, solvent based, semitransparent, matching topcoat.
 - b. Topcoat: Stain, exterior, solvent based, semitransparent, MPI #13.
 - 1) Minawax Mulberry 473 Semi Trasparent Stain.
 - B. Wood Substrates: Traffic surfaces including Railing
 - 1. Polyurethane Varnish over Stain System MPI INT 6.5B:
 - a. Stain Coat: Stain, semitransparent, for interior wood, MPI #90.
 - 1) Minwax Mullberry 473 Stain Semi-Transparent.
 - b. First Intermediate Coat: Polyurethane varnish matching topcoat.

END OF SECTION 09 93 00

SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Private-use washroom accessories.
 - 2. Private-use shower room accessories.
 - 3. Frameless enclosures.
- B. Related Requirements:
 - 1. Section 09 30 13 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Samples: For each exposed product and for each finish specified, full size.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Certification of compliance with Build America, Buy America Act.
- B. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

1.8 DELIVERY

- A. Deliver products in manufacturers original sealed packaging.
- B. Mark packaging, legibly, to indicate manufacturers name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products with distorted, damaged or opened packaging.

SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES

1.9 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facilities.
- B. Protect products from damage during handling and construction operations.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
 - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
 - 2. Shower Seats: Installed units are able to resist 250 lbf applied in any direction and at any point.

2.2 PRIVATE-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Bradley Corporation</u>.
 - 2. Or approved equal.
- C. Toilet Tissue (Roll) Dispenser: TA-TP
 - 1. Basis-of-Design Product: Bradley, Double-roll dispenser, Model 5234.
 - 2. Description: Double-roll dispenser.
 - 3. Mounting: Surface mounted.
 - 4. Operation: Noncontrol delivery with standard spindle.
 - 5. Capacity: Designed for 5-inch- diameter tissue rolls.
 - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- D. Grab Bar: TA-GB
 - 1. Basis-of-Design Product: Bradley, Grab Bars 1-1/2" with Concealed Mounting, Model 812.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 4. Outside Diameter: 1-1/2 inches.
 - 5. Configuration and Length: As indicated on Drawings.
 - 6. Sizes: Where designation is indicated, provide grab bar in lengths as follows:

a.	GB18	18"	001-18"
h	GB24	24"	001-24"

<i>N</i> .	0021	<u> </u>	00121
c.	GB36	36"	001-36"

- d. GB48 48" 001-48"
- E. Mirror Unit: TA-MI
 - 1. Basis-of-Design Product: Bradley, Channel-Frame Mirror, Model 781-2436.
 - 2. Frame: Stainless steel angle, 0.25 inch thick.
 - a. Corners: Manufacturer's standard.
 - 3. Size:

4.

- a. MI 24"w x 36" h Framed
- Hangers: Manufacturer's standard rigid, tamper and theft resistant.
- F. Robe Hook: TA-RH
 - 1. Basis-of-Design Product: Bradley, Satin Stainless Steel Single Robe Hook, Model 9114.
 - 2. Description: Single-prong unit.

SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES

- 3. Mounting: Concealed.
- 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- G. Towel Hook: TA-TH
 - 1. Basis-of-Design Product: Bradley, Satin Stainless Steel Towel Hook, Model 9314.
 - 2. Description: Single-prong unit.
 - 3. Mounting: Concealed.
 - 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 PRIVATE-USE SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>American Specialties, Inc</u>.
 - 2. <u>Bobrick Washroom Equipment, Inc</u>.
 - 3. Bradley Corporation.
 - 4. GAMCO Specialty Accessories; a division of Bobrick.
 - 5. Wedi Coporation
- C. Folding Shower Seat: TA-SS
 - 1. Basis-of-Design Product: Bradley, Reversible Phenolic Shower Seat, Model 9569.
 - 2. Configuration: L-shaped seat, designed for wheelchair access.
 - 3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
 - 4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- D. Soap Dish: TA-SD
 - 1. Basis-of-Design Product: Bradley, Extra Heavy Duty Stainless Steel Soap Dish, Model 900.
 - 2. Description: Surface mounted
 - 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- E. Towel Hook: TA-TH
 - 1. Basis-of-Design Product: Bradley, Satin Stainless Steel Towel Hook, Model 9314.
 - 2. Description: Single-prong unit.
 - 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- F. Shower Niche
 - 1. Basis-of-Design-Product : Wedi Shower Niche Item Number: US3000004
 - 2. Description: Wedi Shower Niche 16" x 12"
 - 3. Dimensions: 16 in x 12 x 4 in Exterior $12^{\circ} x 8^{\circ} x 3 \frac{1}{2}^{\circ}$ Interior

2.4 FRAMELESS ENCLOSURES

- A. Frameless glass panels with mounting and operating hardware of types and sizes required to support imposed loads.
 - 1. Basis of Design: Agalite Estate Collection
 - a. Agalite manufactures in both the USA and Canada. Make sure all components are manufactured in the USA.
- B. Hardware and Trim: Manufacturer's standard units as indicated and as required for complete installation.
 - 1. Finish: Brushed Nickel
- C. Swinging Doors: Hinged for 90 degrees outwards swing, self-closing. Soft bulb seal or wipes; affixed to door to direct water back into enclosure and provide a tight water seal.
 - 1. Hinges: Side-hinged, 90-degree patch.
 - 2. Door Pulls: Back-to-back, D-pull.
- D. Fixed Panels: Top-and-bottom mounts; match hinges in material and finish.

SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES

- E. Glazing: Safety glazing materials complying with 16 CFR 1201, Category II, with permanently etched identification acceptable to authorities having jurisdiction.
 - 1. Glass Nominal Thickness: As determined by manufacturer based on panel size.
 - 2. Clear Glass: ASTM C1048, Type I, Quality-Q3, Class I (clear), Kind FT.
 - a. Obscured Panels: Sandblasted.
 - 3. Protective, Self-Cleaning, Glass Coating: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
- F. Fasteners: Manufacturer's standard stainless steel or other noncorrosive fasteners.
- G. Sealant: Mildew-resistant, single-component, nonsag, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, for Use NT.
- H. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B209.
 - b. Extrusions: ASTM B221.
 - 2. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 302 or 304.
 - 3. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 302 or 304.
 - 4. Copper-Alloy Sheet and Shapes: ASTM B36/B36M.
 - 5. Copper-Alloy Extrusions: ASTM B455, alloy UNS No. C38500 (architectural brass).

2.5 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inchminimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES

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SECTION 10 44 13 FIRE PROTECTION CABINETS

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. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

1.3 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Certification of compliance with Build America, Buy America Act.
- B. Product Data: For each type of product.
 - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed, or surface-mounting method and relationships of box and trim to surrounding construction.
- C. Shop Drawings: For fire-protection cabinets.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- D. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.
- E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.
- 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.

2.3 FIRE-PROTECTION CABINET <FEC>

A. Cabinet Type: Suitable for fire extinguisher.

SECTION 10 44 13 FIRE PROTECTION CABINETS

- 1. <u>Manufacturers:</u> 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. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Aluminum sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Aluminum sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard hinge, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Materials:
 - Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
 a. Finish: Clear anodic.
 - 2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
- 2.4 FABRICATION
- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Miter corners and grind smooth.
 - 3. Provide factory-drilled mounting holes.
 - 4. Prepare doors and frames to receive locks.
 - 5. Install door locks at factory.
 - B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames and grind smooth.

SECTION 10 44 13 FIRE PROTECTION CABINETS

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

Β.

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:
 - 1. Fire-Protection Cabinets: 48 inches above finished floor to top of fire extinguisher.
 - Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
- Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 Identification:
 - 1. Apply decals or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factoryfinished appearance. Use only materials and procedures recommended or furnished by fireprotection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 13 FIRE PROTECTION CABINETS

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SECTION 12 21 13 HORIZONTAL LOUVER BLINDS

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: Horizontal louver blinds with polymer slats. Motorized operators.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details. Motorized Operators: Include details of installation in headrails and include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.
- D. Samples for Initial Selection: For each type and color of horizontal louver blind. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type and color of horizontal louver blind indicated. Slat: Not less than 12 inches long. Tapes: Full width, not less than 6 inches long. Horizontal Louver Blind: Full-size unit, not less than 16 inches wide by 24 inches long. Valance: Full-size unit, not less than 12 inches wide.
- F. Product Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For horizontal louver blinds with polymer slats that have been tested for compliance with NFPA 701, for tests performed by a qualified testing agency.
- B. Certification of Compliance with the Build America Buy America Act

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from

SECTION 12 21 13 HORIZONTAL LOUVER BLINDS

Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.
- B. Hunter Douglas

2.2 HORIZONTAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.
- D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish: Fabric: Gelato, E26-772 Hunter Douglas – Applause Cellular Shades
- PART 3 Cordless EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds. Install mounting and intermediate brackets to prevent deflection of headrails.

Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

B. Electrical Connections: Connect motorized operators to building electrical system.

SECTION 12 21 13 HORIZONTAL LOUVER BLINDS

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 12 21 13

DIVISION 12 - FURNISHINGS

SECTION 12 21 13 HORIZONTAL LOUVER BLINDS

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DIVISION 12 - FURNISHINGS

SECTION 12 36 61.16 SOLID SURFACING COUNTERTOPS

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

D.

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.
 - Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Complication Certification of Build America, Buy America Act

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.
- 1.6 QUALITY ASSURANCE
 - A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful inservice performance.
 - B. Installer Qualifications: Fabricator of countertops.
- 1.7 A mockup may be a reasonable precaution for projects that require many solid surface material countertops, but it may be impractical for other applications.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.9 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

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- 1. Type: Provide Standard type or Veneer type made from material complying with requirements for Standard type, as indicated unless Special Purpose type is indicated.
- 2. Colors and Patterns:
- 3. SANDALWOOD- Kitchen with full height backsplash
- 4. VENARO WHITE- Bathrooms no backsplash needed.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Economy.
- B. Configuration:
 - 1. Front: 3/4-inch bullnose
 - 2. Backsplash: Straight, slightly eased at corner
 - 3. End Splash: Matching backsplash
- C. Countertops: 3/4-inch- thick, solid surface material
- D. Backsplashes 3/4-inch- thick, solid surface material
- E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
 - 2. Install integral sink bowls in countertops in the shop.
- F. Joints: Fabricate countertops without joints.
- G. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.
 - 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
 - 2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
- H. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
 - c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.
 - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for plumbing fittings and similar items.

2.3 INSTALLATION MATERIALS

1.

- A. Adhesive: Product recommended by solid surface material manufacturer.
 - Mounting Adhesives
 - a. Provide structural grade silicon or epoxy adhesives of type recommended by manufacturer for application and conditions of use. Provide spaces, if required of type recommended by adhesive manufacturer.
 - 2. Joint Sealants.
 - a. Use clear silicone sealant of type recommended by manufacturer for application and conditions of use. Provide anti-bacterial type in toilet and bathrooms and food preparation areas.
DIVISION 12 - FURNISHINGS

SECTION 12 36 61.16 SOLID SURFACING COUNTERTOPS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Examine casework grounds and supports for adequate anchorage, foreign material, moisture, and unevenness that could prevent quality casework installation. Ensure that electrical and plumbing rough ins for casework are complete. Do not proceed with installation until defects are corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/16 inch in 10 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Secure countertops to cabinetry and wall construction using 1/4" diameter masonry anchors, spaced 30 inches maximum on center.
- C. Submit installation drawings for countertops. Ensure drawings include location of cabinets, details of cabinet's related and dimensional position and location for roughing in plumbing, including sinks, faucets, strainers, and cocks. I
- D. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- F. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- G. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- H. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- I. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- J. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- K. Apply sealant to gaps at walls

ADJUSTING AND CLEANING:

A. Solvent

Use a product recommended by adhesive manufacturer to clean surface of quarts surfacing to assure adhesion of adhesives (and sealants)

SECTION 12 36 61.16 SOLID SURFACING COUNTERTOPS

B. Cleaning Agents

Use non-abrasive, soft scrub type kitchen cleaners.

C. Cleaning

On completion of cabinet installation, touch up marred or abraded finished surfaces. Removed crating and packing materials from premises. Wipe down surfaces to remove fingerprints and marking and leave in clean condition.

END OF SECTION 12 36 61.16

SECTION 21 05 00 COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Floor plates.
 - 8. Grout.
 - 9. HVAC demolition.
 - 10. Equipment installation requirements common to equipment sections.
 - 11. Painting and finishing.
 - 12. Concrete bases.
 - 13. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view inside building. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outside building or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outside ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

Α.

- Product Data: For the following:
- 1. Mechanical sleeve seals.
- 2. Escutcheons.
- B. Welding certificates.

1.5 ADDITIONAL REQUIRED DATA

- A. All materials, equipment, and devices shall comply with the Infrastructure and Investment and Jobs Act Title IX Build America, Buy America (BABA). Submittals shall indicate compliance with BABA requirements. Reference Section 01 33 23 "Shop Drawing Product Data and Samples" for additional information.
- 1.6 QUALITY ASSURANCE
 - A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
 - B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

SECTION 21 05 00 COMMON WORK RESULTS FOR FIRE SUPPRESSION

- 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
- 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Materials and equipment stored on the site shall have protective covering to prevent damage and to prevent entrance of dirt, debris, and moisture.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

SECTION 21 05 00 COMMON WORK RESULTS FOR FIRE SUPPRESSION

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 **SLEEVES**

- Α. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent ductile-iron pressure pipe, with plain ends and integral waterstop.
- Galvanized-Steel Wall Pipes: ASTM A 53, Schedule 40, with plain ends and welded steel Β. collar: zinc coated.
- Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with C. plain ends.
- D. Galvanized-Steel-Sheet Sleeves: Round sheet metal tube closed with welded longitudinal joint. Minimum sheet metal thickness as follows:
 - For sleeves 12-inches and smaller: 1.
 - 2. For sleeves 13-inches to 16-inches:
 - 3. For sleeves 17-inches to 20-inches:
 - For sleeves 20-inches and larger: 4.

2.5 MECHANICAL SLEEVE-SEAL SYSTEMS

- Description: Modular sealing element unit, designed for field assembly, to fill annular space Α. between pipe and sleeve.
 - Manufacturers: 1.
 - Advance Products & Systems, Inc. a.
 - Calpico, Inc. b.
 - Metraflex Co. C.
 - Pipeline Seal and Insulator, Inc. d.
 - Proco Products. Inc. e.
 - Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include 2. type and number required for pipe material and size of pipe.
 - Pressure Plates: Plastic. Include two for each sealing element. 3.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

ESCUTCHEONS 2.6

- Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely Α. fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
 - 1. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
 - 2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
 - 3. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

FLOOR PLATES 2.7

- One-Piece Floor Plates: Cast-iron flange with holes for fasteners. Α.
- Β. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.8 GROUT

- Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, Α. hvdraulic-cement arout.
- Β. Characteristics: Nonshrink; recommended for interior and exterior applications.
- Design Mix: 5000-psi, 28-day compressive strength. C.
- D. Packaging: Premixed and factory packaged

- 0.0396-inch thickness (20-gauge).
- 0.0336-inch thickness (22-gauge).
- 0.0516-inch thickness (18-gauge).

0.0276-inch-thickness (24-gauge).

SECTION 21 05 00 COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. 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, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at required slopes, but not less than required by the building code.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Select system components with pressure rating equal to or greater than system operating pressure.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using leadfree solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

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.

3.4 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, walls, partitions, roofs, and as otherwise indicated.

Α.

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- B. Sleeves are not required for core-drilled holes, except where sleeves are required to extend above the floor in wet areas.
- C. Cut sleeves to length for mounting flush with both surfaces.
 - 1. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2- inches above finished floor level.
- D. Install sleeves in new above ground concrete floors, concrete roof slabs, and concrete walls as they are constructed. Cut sleeves into existing floors, roof slabs and walls.
- E. For sleeves cut into floors, roof slabs, and walls, use grout to seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- F. Install sleeves for pipes passing through concrete and masonry walls, and gypsum-board walls that are fire- and/or smoke-rated.
- G. Install sleeves that are large enough to provide 1/4-inch to 1/2-inch annular clear space between sleeve and pipe or pipe insulation.
- H. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- I. Fire- and/or Smoke-Barrier Penetrations: Maintain indicated fire- and smoke- rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.5 MECHANICAL SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install mechanical sleeve-seal systems in pipe sleeves in below grade exterior concrete at service piping entries into building, and as indicated.
- B. Assemble fitting components of length to be flush with both surfaces of concrete walls. Position waterstop flange in the center of concrete walls.
- C. 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.
- D. Use grout to seal the space around the outside of sleeves in slabs and walls.

3.6 SLEEVE AND MECHANICAL SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls below Grade:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve with mechanical sleeveseal.
 - b. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 2. Exterior Concrete Walls above Grade:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve. No mechanical sleeve seal is required, unless otherwise indicated. Seal annular space with a waterproofing sealer.
 - 3. Concrete Slabs-on-Grade:
 - a. All Piping Sizes: No pipe sleeve or mechanical sleeve seal, unless otherwise indicated. Pour concrete slab around piping. Seal annular space with a waterproofing sealer.
 - 4. Concrete Slabs above Grade:
 - a. Cast-iron or galvanized-steel pipe sleeve. No mechanical sleeve seal is required, unless otherwise indicated. Seal annular space with a waterproofing sealer.
 - 5. Interior Concrete or Masonry Walls:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

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- 6. Interior Gypsum-Board Walls:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Galvanized Sheet Metal Sleeves may be used for all pipe sizes penetrating gypsum-board partitions.Interior Gypsum-Board Walls that are fire- and/or smoke-rated:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Galvanized Sheet Metal Sleeves may be used for all pipe sizes penetrating gypsum-board partitions.
- 8. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.7 ESCUTCHEON AND FLOOR PLATE 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 piping and with OD that completely covers opening.
 - Escutcheons for New and Existing Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type with polished, chrome-plated finish, and setscrew fastener.
 - 2. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
 - 3. Insulated Piping: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
 - 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
 - 5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or splitcasting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
 - 6. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
- 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.

3.8 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.
- B. Verify final equipment locations for roughing-in.
- C. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- E. Install fire suppression equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- F. Install equipment to allow right of way for piping installed at required slope.

3.9 PAINTING

A. Remove markings, stickers, tags, lubricants, protective oils, and other substances and repair damaged surfaces of equipment, piping, ductwork that will be exposed to view in finished spaces.

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B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.10 CONCRETE BASES

- A. Concrete Bases and Curbs: Cast-in-place bases and curbs are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate sizes and locations, and provide attachments as follows;
 - 1. Provide scaled layouts of bases and curbs with sizes and locations dimensioned to concrete walls and columns.
 - 2. Determine base and curb size based on purchased equipment shop drawings. Base sizes and locations shall not be scaled from Drawings.
 - 3. Construct concrete bases of dimensions indicated, but not less than 4-inches larger in both directions than supported unit.
 - 4. Anchor equipment to concrete bases and curbs according to manufacturer's installation instructions and according to seismic codes at Project.
 - B. Construction Details: If not detailed in Division 03, provide the following:Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 6. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.12 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor firesuppression materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.13 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 21 05 00

SECTION 21 05 00 COMMON WORK RESULTS FOR FIRE SUPPRESSION

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SECTION 21 05 53

IDENTIFICATION FOR FIRE SUPPRESSION 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.
- B. Valve Schedules: Valve numbering scheme.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, with 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 (71 deg C).
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 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, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- A. A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, with 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 (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and

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IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

proportionately larger lettering for greater viewing distances. Include secondary lettering twothirds to three-fourths the size of principal lettering.

- G. Fasteners: Stainless-steel 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.
 - 1. Lettering Size: At least 1-1/2 inches (38 mm) high.
- D. Pipe-Label Colors:
 - 1. Background Color: Red.
 - 2. Letter Color: White.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping-system abbreviation and 1/2-inch (13-mm) numbers.
 - 1. Tag Material: Brass, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain.
 - 3. Valve-Tag Color: Red.
 - 4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) 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: Approximately 4 by 7 inches (100 by 178 mm).
 - 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 LABEL INSTALLATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.

SECTION 21 05 53 IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

- E. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection excluding short takeoffs. 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.

3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 - 1. Valve-Tag Size and Shape:
 - a. Wet-Pipe Sprinkler System: 1-1/2 inches (38 mm).
- 3.4 WARNING-TAG INSTALLATION
 - A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 05 53

SECTION 21 05 53 IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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SECTION 21 13 13 WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Specialty valves.
 - 4. Backflow preventers.
 - 5. Sprinklers.
 - 6. Alarm devices.
 - 7. Pressure gages.
- B. Related Sections:
 - 1. Division 28 Section "Digital, Addressable Fire-Alarm System" for fire alarm connections to water flow indicators, pressure switches, supervisory switches, and alarm devices for fire protection systems.
 - 2. Division 33 Section for site water service work not specified in this Section.

1.3 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to a water supply through a water flow alarm device. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible a glass bulb or metal link device.

1.4 DELEGATED DESIGN:

A. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified engineer or sprinkler system designer, using performance and design criteria indicated in addition to the requirements of NFPA 13R and the state and local fire authorities having jurisdiction. Obtain approval from the authority having jurisdiction.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system designed to operate at working pressure of 175-psig maximum.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Sprinkler System Protection Limits: All remodeled areas of the existing building. Provide 100 percent coverage per NFPA-13R.
 - 1. Provide fire protection piping and sprinkler zones in remodeled areas as indicated:
 - a. Basement.
 - b. First level.
- D. System Water Flow and Pressure:
 - 1. New Systems: Verify water flow and system pressures tests from the serving water utility (from tests not older than 2 years old) as a basis for a cost estimate and bidding. Conduct fire hydrant water flow and pressure tests to obtain data to use as a basis for design for hydraulically calculated system. Submit basis of design with calculations for shop drawing review.
 - 2. The available water flow and pressure are assumed to be adequate without a fire pump.
- E. System Design Criteria:

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- 1. Margin of Safety for Available Water Flow and Pressure: At least 10 psig in excess of requirements at the most remote fire sprinkler, including losses through water-service piping, valves, and backflow preventers.
- 2. Minimum Pipe Sizes: Not smaller than the sizes indicated on the Drawings.
- 3. Maximum Water Velocity: Not in excess of 20 FPS in any section of fire sprinkler or standpipe piping.
- 4. Sprinkler Occupancy Hazard Classifications:
 - a. Bedrooms: Light Hazard.
 - b. Bathrooms: Light Hazard.
 - c. Living Room: Light Hazard.
 - d. Kitchen: Light Hazard.
 - e. Dining Room: Light Hazard.
 - f. Closet: Light Hazard.
 - g. Mechanical and Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - j. Other Areas: As determined by the authority having jurisdiction.
- 5. Minimum Density for Automatic Sprinkler Piping Design:
 - a. Light-Hazard Occupancy, Residential Sprinklers: 0.05 gpm/sq. ft.
 - b. Light Hazard Occupancy, Quick Response Sprinklers: 0.1 gpm/sq. ft.
 - c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft.
- 6. Total Combined Hose-Stream Demand Requirement: Not required per NFPA-13R.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer or fire sprinkler designer responsible for their preparation.
- C. Qualification Data: For qualified Designer and Installer.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13R, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- E. Welding Certificates.
- F. Fire-hydrant flow test report.
- G. Water Flow and System Pressures. Determined from a fire-hydrant flow test conducted by this contractor and with the local water utility. Record and report flow test results.
- H. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13R. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- I. Field quality-control reports.
- J. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Design Engineer's Qualifications: A person who is a professional engineer proficient in fireprotection systems design and qualified to practice in the project area. Or a person who is licensed and who holds a NICET Level III or IV certification in the field of fire protection system design. Fire protection system engineers/designers shall meet the qualifications of and be acceptable to the fire authority having jurisdiction.
 - 1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports. Provide engineering services needed to assume full responsibility for the fire sprinkler design. The printed name and license number of the design/engineer/system designer shall be affixed on the working plans, calculations, and field test reports.

SECTION 21 13 13 WET-PIPE SPRINKLER SYSTEMS

- B. Installer Qualifications: Firms licensed to design, fabricate, install and alter fire-protection piping, equipment, specialties, and accessories, and repair and service equipment. A qualified firm is one that is experienced (minimum of 5 previous projects similar in size and scope of this Project) in such work, familiar with the precautions required, and in compliance with the requirements of the authority having jurisdiction.
 - 1. Installer's Responsibility: Fabricating and installing sprinkler systems in accordance with prepared and approved fire-sprinkler drawings.
- C. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- D. 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.
- E. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13R, "Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies." 2019 Edition, if not newer as prescribed by the Building Code.

1.8 COORDINATION

- A. Coordinate the water service pipe extension into the building with the Work of the site utilities contractor.
- B. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13R and sprinkler wrench. Separate cabinet not required for different sprinkler head types, but labeling of sprinkler types and owner training will be necessary to indicate which sprinklers are installed where.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795, Type E; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13R-specified wall thickness in NPS 6 to NPS 10, plain end, which is manufactured domestically and specifically for application in fire-sprinkler systems, such as Allied Tube and Conduit Schedule 10.
- E. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, standardweight, seamless steel pipe with threaded ends.
- F. Galvanized- and Uncoated, Steel Couplings: ASTM A 865, threaded.

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- G. Galvanized- and Uncoated Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- H. Malleable- or Ductile-Iron Unions: UL 860.
- I. Cast-Iron Flanges: ASME 16.1, Class 125.
- J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- K. Steel Welding Fittings: ASTM A 234 and ASME B16.9.
- L. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Fittings shall be manufactured domestically.
 - a. Anvil International, Inc.
 - b. Tyco Fire Protection Products LP; Grinnell.
 - c. Victaulic Company.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.4 CPVC PIPE AND FITTINGS

- A. CPVC Pipe: ASTM F442/F442M "Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-13.5). The pipe compound shall meet cell class 23547 as defined by ASTM D1784. Additionally the pipe must be marked with the following pressure ratings: "320 PSI @ 73°F", "175 PSI @ 150°F", and "100 PSI @ 180°F".
 B. CPVC Fittings: Shall meet or exceed the requirements of ASTM F437 for Schedule 80
- B. CPVC Fittings: Shall meet or exceed the requirements of ASTM F437 for Schedule 80 threaded, ASTM F438 for Schedule 40 socket, or ASTM F439 for Schedule 80 socket. Fitting compound shall meet cell class 24447 as defined by ASTM D1784.
- C. Both pipe and fittings shall be Listed by Underwriters Laboratories for use in automatic fire sprinkler systems and shall bear the logo of the Listing Agency. Pipe and fittings shall also be certified by NSF International for use with potable water.
- D. Ancillary products and devices shall be chemically compatible the specified CPVC pipe.

2.5 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Člass 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for generalduty brazing unless otherwise indicated. (include for copper tube and fittings)
- D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steep pipe being welded.

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E. Solvent Welding: All socket type joints shall be assembled with solvent cements that meet or exceed the requirements of ASTM F493. Safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be certified by NSF International for use with potable water and approved by the manufacturers.

2.6 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed or FM approved.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
 - B. Ball Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Milwaukee Valve Company.
 - c. Nibco, Inc.
 - d. Tyco Fire & Building Products.
 - e. Victaulic Company.
 - 2. Standard: UL 1091 except with ball instead of disc.
 - 3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 - 4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
 - 5. Valves NPS 3: Ductile-iron body with grooved ends.
 - C. Iron Butterfly Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Milwaukee Valve Company.
 - c. Nibco, Inc.
 - d. Tyco Fire Protection Products LP; Grinnell.
 - e. Victaulic Company.
 - 2. Standard: UL 1091.
 - 3. Pressure Rating: 175 psig.
 - 4. Body Material: Cast or ductile iron.
 - 5. Style: Lug-style.
 - 6. End Connections: Grooved.
 - D. Check Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Milwaukee Valve Company.
 - d. Nibco, Inc.
 - e. Reliable Automatic Sprinkler Co., Inc.
 - f. Tyco Fire Protection Products LP; Grinnell.
 - g. Victaulic Company.
 - h. Viking Corporation.
 - i. Watts Water Technologies, Inc.
 - 2. Standard: UL 312.
 - 3. Pressure Rating: 250 psig minimum.
 - 4. Type: Swing check.
 - 5. Body Material: Cast iron.
 - 6. End Connections: Flanged or grooved.
 - E. Iron OS&Y Gate Valves:

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- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - Crane Co.; Crane Valve Group; Crane Valves. a.
 - Hammond Valve. b.
 - Milwaukee Valve Company. c.
 - d. Nibco, Inc.
 - Tyco Fire & Building Products. e.
 - Watts Water Technologies, Inc. f.
- 2. Standard: UL 262.
- Pressure Rating: 175 psig minimum. 3.
- Body Material: Cast or ductile iron. 4.
- End Connections: Flanged or grooved. 5.
- F. Indicating-Type Butterfly Valves:
 - Manufacturers: Subject to compliance with requirements, provide products by one of the 1. following:
 - Anvil International, Inc. a.
 - b. Milwaukee Valve Company.
 - Nibco, Inc. c.
 - d. Tyco Fire Protection Products LP; Grinnell.
 - Victaulic Company. e.
 - 2. Standard: UL 1091.
 - Pressure Rating: 175 psig minimum. 3.
 - Valves NPS 2 and Smaller: 4.
 - Valve Type: Ball or butterfly. a.
 - Body Material: Bronze. b.
 - End Connections: Threaded. c.
 - 5. Valves NPS 2-1/2 and Larger:
 - Valve Type: Butterfly. a.
 - b. Body Material: Cast or ductile iron.
 - C. End Connections: Flanged or grooved.
 - 6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch with visual indicating device. Coordinate electrical requirements with Division 28 Sections for fire alarm connections.

2.7 TRIM AND DRAIN VALVES Α.

- General Requirements:
 - Standard: UL's "Fire-Protection Equipment Directory" listing or "Approval Guide." 1. published by FM Global, listing.
 - 2. Pressure Rating: 175 psig minimum.
- Β. Ball Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - Milwaukee Valve Company. C.
 - d. Nibco, Inc.
 - Tyco Fire Protection Products LP; Grinnell. e.
 - Victaulic Company. f.
 - Watts Water Technologies, Inc. g.
- 2.8 SPECIALTY VALVES
 - Α. General Requirements:

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- 1. Standard: UL's "Fire-Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- 2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
- 3. Body Material: Cast or ductile iron.
- 4. Size: Same as connected piping.
- 5. End Connections: Flanged or grooved.
- B. Automatic (Ball Drip) Drain Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire Protection Products LP; Grinnell.
 - c. Viking Corporation.
 - 2. Standard: UL 1726.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Type: Automatic draining, ball check.
 - 5. Size: NPS 3/4.
 - 6. End Connections: Threaded.

2.9 BACKFLOW PREVENTERS

- A. Double-Check, Backflow-Prevention Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Febco; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products Division.
 - 2. Standard: ASSE 1015 or AWWA C510.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 5 psig maximum, through the middle one-third of flow range.
 - 5. Body Material: For NPS 2-1/2 and larger cast iron with an epoxy-coated interior lining complying with AWWA C550 or that is FDA approved, or stainless steel.
 - 6. End Connections: Flanged for NPS 2-1/2 and larger.
 - 7. Configuration: Designed for horizontal, straight through flow.
 - 8. Accessories: O,S&Y gate valves with flanged ends on inlet and outlet. Inlet strainer.
 - 9. Test Kit: Factory calibrated, with gages, fittings, hoses, and carrying case with testprocedure instructions.

2.10 SPRINKLER SPECIALTY PIPE FITTINGS

- A. Branch Outlet Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire Protection Products LP; Grinnell.
 - c. Victaulic Company.
 - 2. Standard: UL 213.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - 5. Type: Mechanical-T and -cross fittings.
 - 6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.

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- 7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
- 8. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire Protection Products LP; Grinnell.
 - c. Victaulic Company.
 - d. Viking Corporation.
 - 2. Standard: UL's "Fire-Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.
- C. Branch Line Testers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.
 - 2. Standard: UL 199.
 - 3. Pressure Rating: 175 psig.
 - 4. Body Material: Brass.
 - 5. Size: Same as connected piping.
 - 6. Inlet: Threaded.
 - 7. Drain Outlet: Threaded and capped.
 - 8. Branch Outlet: Threaded, for sprinkler.
- D. Sprinkler Inspector's Test Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire Protection Products.
 - c. Victaulic Company.
 - d. Viking Corporation.
 - 2. Standard: UL's "Fire-Protection Equipment Directory "lists" or "Approval Guide," published by FM Global, listing.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with sight glass.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.
- E. Adjustable Drop Nipples: Not allowed.
- F. Flexible, Sprinkler Hose Fittings: Not allowed.
- 2.11 SPRINKLERS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Reliable Automatic Sprinkler Co., Inc.
 - 2. Tyco Fire Protection Products LP; Grinnell.
 - 3. Victaulic Company.
 - 4. Viking Corporation.

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- B. General Requirements:
 - 1. Standard: UL's "Fire-Protection Equipment Directory listing or "Approval Guide," published by FM Global, listing.
 - 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 6.8, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
 - 2. Residential Style sprinkler rated for Flow and Discharge Coefficient K as required and listed per NFPA-13R.
- D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, one-piece flat. Not more than 3-inch diameter and 1/4-inch deep.
 - 2. Sidewall Mounting: Chrome-plated steel, one-piece flat. Not more than 3-inch diameter and 1/4-inch deep.
- 2.12 ALARM DEVICES
 - A. Alarm-device types shall match piping and equipment connections.
 - B. Electrically Operated Alarm Bell: Alarm bell or horn provided as Work of Division 28. Coordinate requirements.
 - C. Water-Flow Indicators:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Watts Industries (Canada) Inc.
 - 2. Standard: UL 346.
 - 3. Water-Flow Detector: Electrically supervised.
 - 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed. Coordinate electrical requirements with Division 28 Sections for fire alarm connections.
 - 5. Type: Paddle operated.
 - 6. Pressure Rating: 250 psig.
 - 7. Design Installation: Horizontal or vertical.
 - D. Pressure Switches:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Potter Electric Signal Company.
 - b. System Sensor; a Honeywell company.
 - c. Tyco Fire & Building Products LP.
 - d. Viking Corporation.
 - 2. Standard: UL 346.
 - 3. Type: Electrically supervised water-flow switch with retard feature.
 - 4. Components: Single-pole, double-throw switch with normally closed contacts. Coordinate electrical requirements with Division 28 Sections for fire alarm connections.
 - 5. Design Operation: Rising pressure signals water flow.
 - E. Valve Supervisory Switches:

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- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
- 2. Standard: UL 346.
- 3. Type: Electrically supervised.
- 4. Components: Single-pole, double-throw switch with normally closed contacts. Coordinate electrical requirements with Division 28 Sections for fire alarm connections.
- 5. Design: Signals that controlled valve is in other than fully open position.
- 2.13 PRESSURE GAGES
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ametek; U.S. Gauge Division.
 - 2. Ashcroft, Inc.
 - B. Standard: UL 393.
 - C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
 - D. Pressure Gage Range: 0 to 250 psig.
 - E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

- 3.1 PREPARATION
 - A. Perform fire-hydrant flow test according to NFPA 13R and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
 - B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for piping outside the building. Water service piping is specified as work of Division 33.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler and standpipe piping in NFPA 13R.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13R. When drain piping extends to outside building, provide a chrome-plated brass escutcheon and pipe extended out 1-1/2-inches so that drain water does not drip onto building materials. Any automatic drains extended outside that could

SECTION 21 13 13 WET-PIPE SPRINKLER SYSTEMS

result in freezing shall be heat traced. Coordinate requirements with Div. 26. It is preferred to extend all automatic drains to interior floor drain wherever possible.

- G. Install sprinkler piping as high as possible. Maintain maximum clearance below exposed piping.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers where indicated.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to floor drain or extend to drain outside the building. Provide a chrome-plated brass escutcheon and pipe extended out 1-1/2-inches so that drain water does not drip onto building materials.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13R. Comply with requirements for hanger materials in NFPA 13R.
 - 1. Design pipe hangers and equipment supports using performance requirements and design criteria indicated. If necessary, engage the services of a professional engineer to provide pipe hangers and equipment support design assistance.
 - 2. Detail fabrication and assembly of hangers and supports.
 - 3. Design calculations shall include load bearing capacities of building component to which hangers and supports are attached.
 - 4. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure. Do not install building attachments to metal roof decking, or other non-structural members.
 - 5. Install pipe hangers and supports at intervals of not more than 12 feet on-center.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each system. Include pressure gages with connection not less than NPS 1/4 and with a ball valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Fill sprinkler system piping with water.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Common Work Results for Fire-Protection."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 21 Section "Common Work Results for Fire Protection."

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

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- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- K. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- L. 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.
- M. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13R and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

3.6 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install bypass piping around backflow preventers.
- C. Provide substantial support for NPS 2-1/2 and larger backflow preventers and piping. Use manufactured products supported from the floor.

3.7 SPRINKLER INSTALLATION

- A. Install sprinklers in a regular pattern, perpendicular and parallel with building lines, in perfect alignment with other sprinklers and other ceiling components such as lights, air diffusers, grilles, and speakers.
- B. Install sprinklers in the center of ceilings wherever possible. Note the presence of ceiling pockets created of soffits in lower level bedrooms. Maintain all required clearances per NFPA 13R when dealing with ceiling pockets.
- C. Install sprinklers no closer than 4 inches from any ceiling edge or from any ceiling component.
- D. Sprinkler locations shall be reviewed and accepted by the Architect before any piping is fabricated or installed. Additional sprinklers, in excess of NFPA requirements, may be required for aesthetics; allow for additional sprinklers in the bid cost.
- E. Install dry-type sprinklers with water supply from heated space. Do not install wet-sprinklers in areas subject to freezing, such as entrance vestibules.
- F. Refer to Sprinkler Schedule later in this Section for sprinkler types and locations.

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3.8 SPRINKLER ZONE DRAIN INSTALLATION

A. Extend drain pipe from drain valve to drain outside the building. Provide a chrome-plated brass escutcheon and pipe extended out 1-1/2-inches so that drain water does not drip onto building materials.

3.9 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13R.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 28 Section ""Digital, Addressable Fire-Alarm System."

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13R and 14, "Systems Acceptance" Chapters.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire sprinkler system.

3.13 PIPING SCHEDULE

- A. Exposed Piping Within 10'-0" of the floor shall be the following:
 - 1. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Piping for wet-pipe sprinkler system where concealed shall be one of the following:
 - 1. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
 - 2. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
 - 3. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
 - 4. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13R-specified wall thickness in NPS 6 to NPS 10, plain end, which is manufactured domestically and specifically for application in fire-sprinkler systems, such as Allied Tube and Conduit Schedule 10.
 - 5. Type L, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.

SECTION 21 13 13 WET-PIPE SPRINKLER SYSTEMS

6. NSF International listed CPVC pipe with solvent welded fittings similar to BlazeMaster.

3.14 SPRINKLER SCHEDULE

Α.

- Use sprinkler types in subparagraphs below for the following applications:
 - 1. Service Areas, Mechanical and Electrical Rooms without Ceilings: Upright sprinklers, pipe-mounted.
 - 2. Finished Rooms with Ceilings: Semi-recessed pendent sprinklers.
 - 3. Wall Mounted in Finished Spaces: Recessed sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Dry pendent sprinklers or dry horizontal sidewall sprinklers. Use extended barrel style dry horizontal sidewall sprinklers to protect below deck. Attic not required to be protected per NFPA-13R but reference detail in plans sheets for freeze protection of wet pipe sprinkler routed through attic.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Concealed sprinklers: Rough brass, with factory-painted white escutcheon.
 - 2. Exposed Upright and Sidewall Sprinklers in Finished Spaces: Chrome-plated with chrome-plated escutcheon where exposed to view. Rough bronze where pipe-mounted.
 - 3. Exposed Upright and Sidewall Sprinklers in Unfinished Spaces: Rough bronze in unfinished spaces.

END OF SECTION 21 13 13

SECTION 22 05 00 COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Floor plates.
 - 8. Grout.
 - 9. Plumbing demolition.
 - 10. Equipment installation requirements common to equipment sections.
 - 11. Painting and finishing.
 - 12. Concrete bases.
 - 13. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view inside building. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PVC: Polyvinyl chloride plastic.
 - The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.
- 1.4 SUBMITTALS
 - A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
 - B. Welding certificates.

G.

SECTION 22 05 00 COMMON WORK RESULTS FOR PLUMBING

1.5 ADDITIONAL REQUIRED DATA

A. All materials, equipment, and devices shall comply with the Infrastructure and Investment and Jobs Act – Title IX Build America, Buy America (BABA). Submittals shall indicate compliance with BABA requirements. Reference Section 01 33 23 "Shop Drawing Product Data and Samples" for additional information.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- C. Materials and equipment stored on the site shall have protective covering to prevent damage and to prevent entrance of dirt, debris, and moisture.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. All products and materials shall comply with Federal Build America Buy America (BABA) regulations.
- B. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

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- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 3. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 3. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC or PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

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- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent ductile-iron pressure pipe, with plain ends and integral waterstop.
- B. Galvanized-Steel Wall Pipes: ASTM A 53, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: Round sheet metal tube closed with welded longitudinal joint. Minimum sheet metal thickness as follows:
 - 1. For sleeves 12-inches and smaller:
 - 2. For sleeves 13-inches to 16-inches:
 - 3. For sleeves 17-inches to 20-inches:
 - 4. For sleeves 20-inches and larger:
- 0.0276-inch-thickness (24-gauge).
- 0.0336-inch thickness (22-gauge).
- 0.0396-inch thickness (20-gauge).
- 0.0516-inch thickness (18-gauge).

2.7 MECHANICAL SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Plastic. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
 - 1. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
 - 2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and setscrew fastener.
 - 3. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

2.9 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydrauliccement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.

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D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed. Remove any plumbing piping systems, equipment, and components that are abandoned, inactive or unused. If there are any questions pertaining to existing piping proceed as directed by the Owner.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap remaining piping with same or compatible piping material. Piping to be removed includes piping, fittings, valves, specialties, insulation, hangers, supports, and attachments to structure.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap piping with same or compatible piping material. This applies to abandoned piping concealed behind inaccessible finishes, unless otherwise indicated.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment to be removed includes equipment, accessories, attached piping and ductwork including hangers, supports, and attachments to structure.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes, but not less than required by the building code.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

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3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using leadfree solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846 Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
- 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

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3.5 SLEEVE INSTALLATION

- A. Install pipe sleeves for piping passing through penetrations in floors, walls, partitions, roofs, and as otherwise indicated. Sleeves are not required for core-drilled holes, except where sleeves are required to extend above the floor in wet areas.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2inches above finished floor level.
 - 3. Sleeves are not required for core-drilled holes or holes formed by molded-PE or -PP sleeves, except where sleeves are required to extend above the floor in wet areas.. Remove plastic sleeves if required by the fire authority having jurisdiction.
 - 4. Use grout to seal the space outside of sleeves in slabs and walls.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Install sleeves that are large enough to provide 1/4-inch to 1/2-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- E. Fire- and/or Smoke-Barrier Penetrations: Maintain indicated fire- and smoke- rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.6 MECHANICAL SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install mechanical sleeve-seal systems in pipe sleeves in below grade exterior concrete at service piping entries into building, and as indicated.
- B. Assemble fitting components of length to be flush with both surfaces of concrete walls. Position waterstop flange in the center of concrete walls.
- C. 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.
- D. Use grout to seal the space around the outside of sleeves in slabs and walls.

3.7 SLEEVE AND MECHANICAL SLEEVE-SEAL SCHEDULE

- Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls below Grade:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve with mechanical sleeveseal.
 - b. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 2. Exterior Concrete Walls above Grade:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve. No mechanical sleeve seal is required, unless otherwise indicated. Seal annular space with a waterproofing sealer.
 - 3. Concrete Slabs-on-Grade:
 - a. All Piping Sizes: No pipe sleeve or mechanical sleeve seal, unless otherwise indicated. Pour concrete slab around piping. Seal annular space with a waterproofing sealer.
 - 4. Concrete Slabs above Grade:
 - a. Cast-iron or galvanized-steel pipe sleeve. No mechanical sleeve seal is required, unless otherwise indicated. Seal annular space with a waterproofing sealer.

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- 5. Interior Concrete or Masonry Walls:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- 6. Interior Gypsum-Board Walls:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Galvanized Sheet Metal Sleeves may be used for all pipe sizes penetrating gypsum-board partitions.Interior Gypsum-Board Walls that are fire- and/or smoke-rated:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Galvanized Sheet Metal Sleeves may be used for all pipe sizes penetrating gypsum-board partitions.
- 8. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.8 ESCUTCHEON AND FLOOR PLATE 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 piping and with OD that completely covers opening.

Escutcheons for New and Existing Piping:

- 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type with polished, chrome-plated finish, and setscrew fastener.
- 2. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
- 3. Insulated Piping: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
- 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
- 5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or splitcasting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
- 6. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with concealed hinge, and with polished chrome-plated finish, and setscrew fastener.
- 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.

3.9 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.
- B. Verify final equipment locations for roughing-in.
- C. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- E. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- F. Install equipment to allow right of way for piping installed at required slope.
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3.10 PAINTING

- A. Remove markings, stickers, tags, lubricants, protective oils, and other substances and repair damaged surfaces of equipment, piping, ductwork that will be exposed to view in finished spaces. Clean and prepare surfaces that are specified to be finish painted.
- B. Painting of plumbing systems, equipment, and components, if any, is specified in Division 9 Sections "Interior Painting".
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.11 CONCRETE BASES

- A. Concrete Bases and Curbs: Cast-in-place bases and curbs are specified in Division 03 Section "Cast-in-Place Concrete."
 - 1. Provide scaled layouts of bases and curbs with sizes and locations dimensioned to concrete walls and columns.
 - 2. Determine base and curb size based on purchased equipment shop drawings. Base sizes and locations shall not be scaled from Drawings.
 - 3. Construct concrete bases of dimensions indicated, but not less than 4-inches all around supported unit.
 - 4. Anchor equipment to concrete bases and curbs according to manufacturer's installation instructions and according to seismic codes at Project.
- B. Construction Details:Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 6. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.12 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.13 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.
- 3.14 GROUTING
 - A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
 - B. Clean surfaces that will come into contact with grout.
 - C. Provide forms as required for placement of grout.
 - D. Avoid air entrapment during placement of grout.
 - E. Place grout, completely filling equipment bases.

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- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 05 00

SECTION 22 05 19 METERS AND GAGES 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. Liquid-in-glass thermometers.
 - 2. Dial-type pressure gages.
 - 3. Gage attachments.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Trerice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - 2. Standard: ASME B40.200.
 - 3. Case: Cast aluminum; 9-inch nominal size.
 - 4. Case Form: Adjustable angle unless otherwise indicated.
 - 5. Tube: Glass with magnifying lens and red organic liquid.
 - 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 - 7. Window: Glass or clear plastic.
 - 8. Stem: Brass or stainless steel and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 - 9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
 - 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ametek, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries
 - d. Marsh Bellofram.
 - e. Trerice, H. O. Co.
 - f. Weiss Instruments, Inc.
- 2. Standard: ASME B40.100.
- 3. Case: Sealed; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
- 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

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- 6. Movement: Mechanical, with link to pressure element and connection to pointer.
- 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
- 8. Pointer: Dark-colored metal.
- 9. Window: Glass or clear plastic.
- 10. Ring: Metal.
- 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.3 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass or stainless-steel pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass ball valve, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Install thermowells with socket extending a minimum of 2 inches into fluid or to center of pipe and in vertical position in piping tees.
 - B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
 - C. Install thermowells with extension on insulated piping.
 - D. Fill thermowells with heat-transfer medium.
 - E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
 - F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
 - G. Install ball valve and snubber in piping for each pressure gage for fluids.
 - H. Install test plugs in piping tees.
 - I. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. And as indicated.
 - J. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Suction and discharge of each domestic water pump.
 - 3. And as indicated.
- 3.2 CONNECTIONS
 - A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.
- 3.4 THERMOMETER SCALE-RANGE SCHEDULE
 - A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
 - B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 100 psi.
- B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION 22 05 19

SECTION 22 05 23 GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

- 1.1 **RELATED DOCUMENTS**
 - Drawings and general provisions of the Contract, including General and Supplementary Α. Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY Α.

- Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.
 - Bronze gate valves. 3.
- **Related Sections:** В.
 - Division 22 Plumbing piping Sections for specialty valves applicable to those Sections only. 1.
 - Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and 2. schedules.
- DEFINITIONS 1.3
 - CWP: Cold working pressure. Α.
 - EPDM: Ethylene propylene copolymer rubber. В.
 - NBR: Acrylonitrile-butadiene. Buna-N. or nitrile rubber. C.
 - NRS: Nonrising stem. D
 - OS&Y: Outside screw and yoke. Ε.
 - F. RS: Rising stem.
 - G. SWP: Steam working pressure.
- 1.4 SUBMITTALS
 - Product Data: For each type of valve indicated. Α.
- 1.5 QUALITY ASSURANCE
 - Source Limitations for Valves: Obtain each type of valve from single source from single Α. manufacturer.
 - Β. 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.
 - ASME B31.9 for building services piping valves. 3
 - C. NSF Compliance: NSF 61 for valve materials for potable water service.

DELIVERY, STORAGE, AND HANDLING 1.6

- Prepare valves for shipping as follows: Α.
 - Protect internal parts against rust and corrosion. 1.
 - Protect threads, flange faces, grooves, and weld ends. 2.
 - Set angle, gate, and globe valves closed to prevent rattling. 3.
 - Set ball valves open to minimize exposure of functional surfaces. 4.
 - Set butterfly valves closed or slightly open. 5.
 - Block check valves in either closed or open position. 6.
- Use the following precautions during storage: Β.
 - Maintain valve end protection. 1.
 - 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.
- Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use C. handwheels or stems as lifting or rigging points.

SECTION 22 05 23 GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Hand Wheel: For valves other than quarter-turn types.
 - 3. Lever Handle: For quarter-turn valves NPS 6 and smaller
 - 4. Chain Wheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. 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.
 - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Solder Joint: With sockets according to ASME B16.18.
 - 4. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. Nibco, Inc.
 - f. Watts Regulator Co.
- 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. For solder-joint tube use threaded-to-solder-joint end adapter with 6-inch extensions (to keep heat away from ball valves).
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Regular.
 - k. Extended stem: On valves in insulated piping.
 - I. Lever handle.
 - m. Balancing stop lever: On valves used for balancing.
- 3. Example: Apollo 70-100 Series. Sizes: 1/4- to 3-inch.

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GENERAL DUTY VALVES FOR PLUMBING PIPING

- 2.3 BRONZE SWING CHECK VALVES A. Class 150. Bronze Swing Check Val
 - Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. Nibco Inc.
 - e. Watts Regulator Co.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 300 psig.
 - d. Body Design: Horizontal flow.
 - e. Body Material: ASTM B 62, bronze.
 - f. Ends: Threaded or solder-end.
 - g. Disc: PTFE or TFE.
 - 3. Example: Nibco T-433-Y and S-433-Y. Sizes: 1/4- to 3-inch.
- 2.4 BRONZE GATE VALVES
 - A. Class 150, RS Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.
 - b. Hammond Valve.
 - c. Kitz Corporation.
 - d. Milwaukee Valve Company.
 - e. Nibco, Inc.
 - f. Powell Valves.
 - g. Watts Regulator Co.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 300 psig.
 - d. Body Material: ASTM B 62, bronze with integral seat and union ring or bolted bonnet.
 - e. Ends: Threaded or solder-end.
 - f. Stem: Bronze.
 - g. Disc: Solid wedge; bronze.
 - h. Packing: Asbestos free.
 - i. Handwheel: Malleable iron.
 - 3. Example: Nibco T-134 or S-134. Sizes: 1/4- to 3-inch.

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.

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- 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 chainwheels on operators for butterfly and gate valves NPS 4 and larger and more than 96 inches above floor, or as otherwise indicated. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level, or in vertical up 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, butterfly, or gate valves.
- 2. Butterfly Valve Dead-End Service: Suitable for dead-end service without downstream flange, fitting or cap.
- 3. Throttling Service except Steam: Ball or butterfly valves with memory stop type device.
- 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger: Iron swing check valves with spring-assist, metal or resilient-seat check 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 with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded or solder-ends. Do not use solderends for ball valves. For solder-joint tube use threaded-to-solder-joint end adapter with 6-inch extensions (to keep heat away from ball valves).
 - 2. For Copper Tubing, NPS 2-1/2 and Larger: Flanged ends or grooved-ends.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 and Larger: Flanged or grooved-ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- Pipe NPS 2 and Smaller:
 - 1. Ball Valves.
 - 2. Bronze Swing Check Valves.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron, Single-Flange Butterfly Valves.
 - 2. Iron, Grooved-End Butterfly Valves.
 - 3. Iron Swing Check Valves.
 - 4. Iron, Grooved-End Swing Check Valves.

END OF SECTION 22 05 23

Α.

SECTION 22 05 29 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. Equipment supports.
 - Related Sections:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

Β.

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 using performance requirements and design criteria indicated. If necessary, engage the services of a professional engineer to provide pipe hangers and equipment support design assistance.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment.
 - 4. Obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Pipe stands.
 - 4. Equipment supports.
- C. Delegated-Design Submittal: For pipe hangers and equipment supports with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of hangers and supports.
 - 2. Design calculations shall include load bearing capacities of building component to which hangers and supports are attached.
- D. Welding certificates.

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- 1.6 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. Galvanized-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized-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 or galvanized carbon steel with non-metallic coating at pipe contact points.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural galvanized-steel shapes with MSS SP-58 galvanized-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. Manufactured 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 in-turned 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 galvanized-steel or stainless steel.
 - 6. Coating: Metallic, painted, or plastic coating (not bare metal).

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carpenter & Paterson, Inc.
 - 2. National Pipe Hanger Corporation.
 - 3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 4. Piping Technology & Products, Inc.
 - 5. Or equivalent.

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- B. Insulation-Insert Material: 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. 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.

2.5 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 or stainless-steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes. Finished supports shall be galvanized or prime-painted.

2.7 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.
 - 1. Do not install building attachments to metal roof decking, or other non-structural members.
 - 2. Each piping system shall be supported independently from structure with a hanger system designed for the application, weight of pipe and contents.
 - B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
 - 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.

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- 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 Division 07 Section "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.
 - 1. Do not install building attachments to metal roof decking, or other non-structural members.
- 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.
 - 1. Do not install piping at slopes less than required by Building Codes.
- 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 weightdistribution 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 weightdistribution 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 high compressive strength insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

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- 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. Galvanized or Prime-Painted Metallic Coatings: Provide galvanized coatings for ferrous hangers and supports, including building attachments, structural steel supports and miscellaneous metals. Prime-painted materials may be used if completed prior to assembly and installation. Provide prime-painted materials for hangers and supports exposed to view.
- B. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop priming. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- C. Galvanized Surfaces: Clean welded connections, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- D. Finish Painting: Clean and prepare surfaces of any hangers and supports that are to be field finish painted. Refer to Division 9 Sections for field finish painting (if any).

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 galvanized-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 systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.

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- 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 non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
 - 4. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30: For support of insulated pipes not subject to expansion or contraction.
 - 6. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 7. 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.
 - 8. 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.
 - 9. 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.
- 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-joist construction, to attach to top flange of structural shape.
 - 3. Various Beam Clamps (MSS Types 20, 21, 22, 23, 25, 27): For attaching to structural steel beams, channels, or angles.
 - 4. 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.

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- 5. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 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. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction. Coordinate fastener and anchor requirements with the project structural engineer.

END OF SECTION 22 05 29

SECTION 22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 **RELATED DOCUMENTS**

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

1.2 SUMMARY Α.

- Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.
 - Warning tags. 4.

1.3 SUBMITTALS

- Product Data: For each type of product indicated. Α.
- Β. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- Coordinate installation of identifying devices with completion of covering and painting of Α. surfaces where devices are to be applied.
- Β. 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

EQUIPMENT LABELS 2.1

- Plastic Labels for Equipment: Α.
 - Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1. 1/8 inch thick, and having predrilled holes for attachment hardware.
 - Letter Color: Black. 2.
 - 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.
 - Adhesive: Contact-type permanent adhesive, compatible with label and with substrate. 8.
- Label Content: Include equipment's Drawing designation or unique equipment number. В. Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 **PIPE LABELS**

- Α. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing. В.
- Pipe Label Contents: Include identification of piping service using same designations or C. abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - Flow-Direction Arrows: Integral with piping system service lettering to accommodate both 1. directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- 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.

2.4 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches.
 - 2. Fasteners: 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. Pipe Labels: Install pipe labels on each piping system. Include arrows showing normal direction of flow. Provide either manufactured self-adhesive plastic labels, or stenciled labels.
- B. 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.

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.

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

- 1. Valve-Tag Schedule: Provide a Valve-tag schedule in operation and maintenance data.
- 3.5 WARNING-TAG INSTALLATION
 - A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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SECTION 22 07 19 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

Α.

Section includes insulating the following plumbing piping systems:

- 1. Domestic cold-water piping.
- 2. Domestic hot-water piping.
- 3. Cold drains and cold drain piping.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting 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.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

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 Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

SECTION 22 07 19 PLUMBING PIPING INSULATION

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.
- C. Do not store or install piping insulation materials until the building is enclosed and weather-tight. Use extra-ordinary means to keep insulation clean and dry.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Piping Insulation Schedule" article 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 I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok HP Ultra.
 - b. Knauf; Earthwool 1000-Degree Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - 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 Max-SSL. Factoryapplied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ Max jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf; Earthwool Pipe and Tank Insulation.
 - d. Knauf; KwikFlex Pipe and Tank Insulation.
 - e. Owens Corning; Fiberglas Pipe and Tank Insulation.
 - f. Owens Corning; Flexwrap.
- 2.2 INSULATING CEMENTS
 - A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Super-Stik.
 - b. Or equivalent.
 - B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

SECTION 22 07 19 PLUMBING PIPING INSULATION

- 1. Products: Subject to compliance with requirements, provide one of the following: Ramco Insulation, Inc.; Thermokote V. a.
 - Or equivalent. b.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - Products: Subject to compliance with requirements, provide one of the following: 1.
 - Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.
 - b. Or equivalent.

2.3 **ADHESIVES**

Β.

- Materials shall be compatible with insulation materials, jackets, and substrates and for bonding Α. insulation to itself and to surfaces to be insulated unless otherwise indicated.
 - Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - Products: Subject to compliance with requirements, provide one of the following: 1.
 - Aeroflex USA, Inc.; Aeroseal. a.
 - b. Armacell LLC: Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company: 85-75.
 - d. Or equivalent.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A. C.
 - Products: Subject to compliance with requirements, provide one of the following: 1
 - Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller a. Company; CP-127.
 - Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller b. Company; 85-60/85-70.
 - Or equivalent. c.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap D. seams and joints. 1.
 - Products: Subject to compliance with requirements, provide one of the following:
 - Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller a. Company: CP-82.
 - Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller b. Company; 85-50.
 - Or equivalent. C.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- Ε. PVC Jacket Adhesive: Compatible with PVC jacket.
 - Products: Subject to compliance with requirements, provide one of the following: 1
 - Dow Corning Corporation; 739, Dow Silicone. a.
 - Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive. b.
 - Speedline Corporation; Polyco VP Adhesive. c.
 - d. Or equivalent.
 - For indoor applications, use adhesive that has a VOC content of 50 g/L or less when 2. calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2.4 MASTICS
 - Materials shall be compatible with insulation materials, jackets, and substrates; comply with Α. MIL-PRF-19565C, Type II.
 - For indoor applications, use mastics that have a VOC content of 50 g/L or less when 1. calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - Β. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

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- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Or equivalent.
- 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 indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - c. Or equivalent.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 3. Service Temperature Range: 0 to 180 deg F.
 - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 - 5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following: a. Childers Brand. Specialty Construction Brands, Inc., a business of H. B. Fuller
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - c. Or equivalent.
 - 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.

2.5 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, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Or equivalent.
 - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over pipe insulation.
 - 4. Service Temperature Range: 0 to plus 180 deg F.
 - 5. Color: White.
- 2.6 SEALANTS
 - A. Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

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- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
- c. Or equivalent.
- 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).
- B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
 - Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Or equivalent.
 - 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.

1.

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).

2.7 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 Max (ASJ+): White, polypropylene-coated, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ Max-SSL: ASJ Max with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK (FRK) Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - e. Or equivalent.
 - 2. Thickness is indicated in field-applied jacket schedules.
 - 3. Adhesive: As recommended by jacket material manufacturer.
 - 4. Color: White.
 - 5. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. RPR Products, Inc.; Insul-Mate.

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- c. Or equivalent.
- 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Finish and thickness are indicated in field-applied jacket schedules.
 - b. Moisture Barrier for Outdoor Applications: 2.5-mil-thick, polysurlyn.
 - c. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 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, provide one of 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 lb force/inch in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Products: Subject to compliance with requirements, provide one of 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 lb force/inch in width.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

SECTION 22 07 19 PLUMBING PIPING INSULATION

2.10 SECUREMENTS

A. Bands:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 - a. Or equivalent.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
 - Wire: 0.062-inch soft-annealed, stainless steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Or equivalent.

PART 3 - EXECUTION

C.

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. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that applies to insulation.
- C. 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.

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- 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
- 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, 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. Manholes.
 - 5. Handholes.
 - 6. 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 below 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.

SECTION 22 07 19 PLUMBING PIPING INSULATION

- 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.
- Ε. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - Comply with requirements in Division 07 Section "Penetration Firestopping" for 1. 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 Division 07 Section "Penetration Firestopping."

GENERAL PIPE INSULATION INSTALLATION 3.5

- Requirements in this article generally apply to all insulation materials except where more A. specific requirements are specified in various pipe insulation material installation articles. Β.
 - Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with 1. 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.
 - Insulate valves using preformed fitting insulation or sectional pipe insulation of same 4. 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.

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- 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.

SECTION 22 07 19 PLUMBING PIPING INSULATION

- 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. Use an insulation product with an equal thickness and density to the preformed sections on adjacent piping insulation.
- 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. Use an insulation product with an equal thickness and density to the preformed sections on adjacent piping insulation.
 - 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 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- B. Where 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.

3.9 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Do not field paint PVC jackets.

SECTION 22 07 19 PLUMBING PIPING INSULATION

- C. Do not field paint aluminum jackets.
- 3.10 FIELD QUALITY CONTROL
 - A. Tests and Inspections:
 - 1. The Architect may inspect pipe, fittings, strainers, and valves insulation by directing removal of field-applied jacket and insulation in layers in reverse order of their installation. The extent of inspection shall be as required to determine compliance with requirements. Re-insulation shall be completed at the Contractor's expense.
 - B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.
- 3.11 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. Underground piping.
 - 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
- 3.12 PIPING INSULATION SCHEDULE
 - A. Domestic Cold Water:

1.

- NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- 2. NPS 1-1/2 and Larger: Insulation shall be the following:
- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Hot Water:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I. 1 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
- 3.13 FIELD-APPLIED JACKET SCHEDULE
 - A. Install jacket over insulation material. For insulation with factory-applied jacket, install the fieldapplied jacket over the factory-applied jacket.
 - B. Insulated Piping, Exposed: Apply to insulated piping within 10'-0" of the floor.
 - 1. PVC Jacket: 20 mils thick.Exception: Piping within Mechanical Rooms.

END OF SECTION 22 07 19

SECTION 22 11 16 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. Aboveground domestic water pipes, tubes, and fittings inside buildings.
- B. Related Sections:
 - 1. Division 31 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 SUBMITTALS

Β.

- A. Product Data:
 - 1. Pressure-seal-joint fittings.
 - 2. Grooved-end copper fittings and couplings.
 - System purging and disinfecting activities report.
- C. Field quality-control reports.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify the Construction Manager no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Construction Manager'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 14 and 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 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.

- 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-Joint Fittings:
 - Manufacturers: Subject to compliance with requirements, provide products by one of the following.
 - a. Nibco Inc.
 - b. Viega.
 - c. Or Equivalent.

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- 2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- 3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- H. Copper-Tube Extruded-Tee Connections:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. T-DRILL Industries Inc.
 - b. Or equivalent.
 - 2. Description: Tee formed in copper tube according to ASTM F 2014.
 - Appurtenances for Grooved End-Copper Tubing:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Grinnell Products; A Tyco International Co.
 - c. Victaulic Company.
 - 2. Bronze Fittings for Grooved-End Copper Tubing: ASTM B 75, copper tube or ASTM B 584, bronze casting.
 - 3. Mechanical Couplings for Grooved-End Copper Tubing:
 - a. Copper-tube dimensions and design similar to AWWA C606.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating: 300 psig.
- 2.3 PIPING JOINING MATERIALS
 - A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110, 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, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

PART 3 - EXECUTION

I.

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "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."
 - 1. Encase under building slab tubing with 3/4-inch thick flexible elastomeric insulation over its entire length; extend insulation above the slab 4-inches.
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water service and at each connection to the existing building domestic water piping. Comply with requirements for pressure gages in Division 22

SECTION 22 11 16 DOMESTIC WATER PIPING

Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."

- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. 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.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- I. Install piping adjacent to equipment and specialties to allow service and maintenance.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Division 22 Section "Meters and Gages for Plumbing Piping."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

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: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints: 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. Pressure-Seal-Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- H. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

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- I. 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.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- 3.4 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.
 - C. Dielectric Fittings for NPS 2-1/2 to NPS 6: Use dielectric flanges or dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." for pipe hanger, support products, and installation
 - 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.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - B. Support vertical piping and tubing at base and at each floor.
 - C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
 - D. 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.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
 - 8. Do not exceed 10-foot maximum hanger spacing.
 - E. Install supports for vertical copper tubing every 10 feet.
 - F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 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. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.
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3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 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.
 - 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.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.
- 2. Open shutoff valves to fully open position.
- 3. Open throttling valves to proper setting.
- 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
- 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.

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3.10 CLEANING

Α.

Clean and disinfect potable domestic water piping as follows:

- 1. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of watersample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 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. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast-or wrought-copper, solder-joint fittings; and brazed or soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
- E. Aboveground domestic water piping, NPS 2-1/2 to NPS 8, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast-or wrought copper, solder-joint fittings; and brazed or soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
- 3.12 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 valves for piping NPS 2 or 3 and smaller. Use butterfly with flanged ends for piping NPS 3 or 4 and larger.
 - 2. Throttling Duty: Use ball valves for piping NPS 3 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 4 and larger.
 - 3. Drain Duty: Hose-end drain valves.
 - B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
 - C. Copper grooved-end valves may be used with grooved-end piping.

END OF SECTION 22 11 16

SECTION 22 11 19 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. Backflow preventers.
 - 2. Water pressure-reducing valves.
 - 3. Temperature-actuated, water mixing valves.
 - 4. Strainers.
 - 5. Drain valves.
 - 6. Flexible connectors.
- B. Related Requirements:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Domestic Water Piping" for water meters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
- 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.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

- A. Double-Check, Backflow-Prevention Assemblies:
 - 1. To be provided by Fire Sprinkler contractor as Double-Check Backflow Preventer must be listed for fire duty.

2.4 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators:
 - 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. Cash Acme; a division of Reliance Worldwide Corporation.
 - b. Conbraco Industries, Inc.
 - c. Honeywell International Inc.
 - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

SECTION 22 11 19 DOMESTIC WATER PIPING SPECIALTIES

- e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
- 2. Standard: ASSE 1003.
- 3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
- 4. Size: See plan details for pipe size.
- 5. Design Flow Rate: See plan details for flow rate.
- 6. Design Outlet Pressure Setting: 80 psig.
- 7. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
- 8. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Point-of-Use Water-Temperature Limiting Devices (Lavs only):
 - 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. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - b. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
 - 2. Standard: ASSE 1070.
 - 3. Pressure Rating: 125 psig (860 kPa).
 - 4. Type: Thermostatically controlled, water mixing valve.
 - 5. Material: Bronze body with corrosion-resistant interior components.
 - 6. Connections: Threaded inlets and outlet.
 - 7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperaturecontrol handle.
 - 8. Tempered-Water Setting: 110 deg F.
 - 9. Valve Finish: Rough bronze.
- B. Individual-Fixture, Water Tempering Valves (Showers):
 - 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. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
 - 2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
 - 3. Pressure Rating: 125 psig (860 kPa) 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 deg F.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

- 1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
- 2. Body: Bronze for NPS 2 (DN 50) 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 (DN 65) and larger.
- 3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
- 4. Screen: Stainless steel with round perforations unless otherwise indicated.
- 5. Drain: Factory-installed, hose-end drain valve.

SECTION 22 11 19 DOMESTIC WATER PIPING SPECIALTIES

2.7 OUTLET BOXES

Α.

Clothes Washer Outlet Boxes:

- 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. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. LSP Products Group, Inc.
 - e. Oatey.
 - f. Plastic Oddities.
 - g. Symmons Industries, Inc.
 - h. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
 - j. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
- 2. Mounting: Recessed.
- 3. Material and Finish: Plastic box and faceplate.
- 4. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
- 5. Supply Shutoff Fittings: NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
- 6. Drain: NPS 1-1/2 (DN 40) standpipe and P-trap for direct waste connection to drainage piping.
- 7. Inlet Hoses: Two 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
- 8. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.
- 2.8 DRAIN VALVES
 - A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - 2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
 - 3. Size: NPS 3/4 (DN 20).
 - 4. Body: Copper alloy.
 - 5. Ball: Chrome-plated brass.
 - 6. Seats and Seals: Replaceable.
 - 7. Handle: Vinyl-covered steel.
 - 8. Inlet: Threaded or solder joint.
 - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
 - B. Gate-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-80 for gate valves.
 - 2. Pressure Rating: Class 125.
 - 3. Size: NPS 3/4 (DN 20).
 - 4. Body: ASTM B 62 bronze.
 - 5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.
 - 6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
 - C. Stop-and-Waste Drain Valves:
 - 1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
 - 2. Pressure Rating: 200-psig (1380-kPa) minimum CWP or Class 125.
 - 3. Size: NPS 3/4 (DN 20).
 - 4. Body: Copper alloy or ASTM B 62 bronze.
 - 5. Drain: NPS 1/8 (DN 6) side outlet with cap.

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2.9 FLEXIBLE CONNECTORS

- 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. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries.
 - 3. Flex Pression, 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.
 - 11. 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 (1380 kPa).
 - 2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
- D. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.
- E. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Division 06 Section "Rough Carpentry."

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements for ground equipment in Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Fire-retardant-treated-wood blocking is specified in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to

SECTION 22 11 19 DOMESTIC WATER PIPING SPECIALTIES

identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

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SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

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.
- 1.4 ACTION SUBMITTALS
 - A. Product Data: For each type of product indicated.
 - B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- PART 2 PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Non-pressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 PVC PIPE AND FITTINGS (ONLY WHERE PERMITTED BY LOCAL CODE)

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Retain subparagraph below for MN projects.
- E. Adhesive Primer: NSF Standard Number 14.
- F. Retain subparagraph below for other than MN projects.
- G. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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- 2. Adhesive primer 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."
- H. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - Solvent cement 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."

PART 3 - EXECUTION

- 3.1 EARTH MOVING
 - A. Comply with requirements for excavating, trenching, and backfilling specified in Division 2 Section "Earthwork."
- 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. 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.
 - K. 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.
 - L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
 - M. Install aboveground PVC piping according to ASTM D 2665.
 - N. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section " Common Work Results for Plumbing."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section " Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

- A. Plastic, Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - 5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- F. Install supports for vertical PVC piping every 48 inches (1200 mm).
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 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:

SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

- 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.
- Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.
- D. Connect force-main piping to the following:
 - 1. Sanitary Sewer: To exterior force main.
 - 2. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 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.
 - Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without

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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.

3.8 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.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of waterbased latex paint.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 - 1. NPS 1-1/4 and NPS 1-1/2: PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. NPS 1-1/4 and NPS 1-1/2: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 3. NPS 2 to NPS 12: PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. NPS 2 to NPS 12: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
- C. Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 - 1. NPS 2 to NPS 12: PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. NPS 2 to NPS 12: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 3. NPS 2 to NPS 12: Cellular-core, Sewer and Drain Series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 4. NPS 12 and NPS 15: Hubless, cast-iron soil piping, and compact, stainless steel couplings. <u>END OF SECTION 22 13 16</u>

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SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Through-penetration firestop assemblies.
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Flashing materials.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Sanitary Waste and Vent Piping.
 - a. BABA compliance documentation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of drainage specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

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B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

- 2.1 CLEANOUTS
 - A. Exposed Metal Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast-iron cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk or raised-head, brass plug.
 - 6. Closure Plug Size: Same as cleanout size.
 - 7. Examples:
 - a. Josam 58910 no-hub cleanout tee with plug.
 - b. Josam 58900 ho-hub cleanout ferrule with plug.
 - B. Metal Floor Cleanouts:

2.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 - Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Type: Threaded, adjustable housing.
- 5. Body or Ferrule: Coated cast-iron.
- 6. Clamping Device: Required for membrane floors.
- 7. Outlet Connection: Inside caulk or no-hub.
- 8. Closure: ABS cleanout plug.
- 9. Adjustable Housing Material: Cast-iron with threads.
- 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, scoriated cover.
- 11. Frame and Cover Shape:
 - a. Round.
 - b. Square for ceramic tile floors and where indicated on the Drawings.
- 12. Top Loading Classification: Medium duty; or heavy duty where indicated.
- 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- 14. Examples:
 - a. Josam 55000-1 Leveleze Kleenatron II, round nickel-bronze cover.
 - b. Josam 55000-1-SQ Leveleze Kleenatron II, square nickel-bronze cover.
 - c. Josam 55000 Leveleze Kleenatron II, heavy duty, round cast iron cover.
- C. Cast-Iron Wall Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.

SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

- d. Watts Drainage Products Inc.
- e. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Body: Hubless, cast-iron soil pipe test tee or wye.
- 5. Closure: Countersunk or raised-head, drilled-and-threaded, brass plug.
- 6. Closure Plug Size: Same size as cleanout size.
- 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
- 8. Examples:
 - a. Josam 58910 no-hub cleanout tee with plug, with Josam 58600 wall access cover.
 - b. Josam 58900 ho-hub cleanout ferrule with plug, with Josam 58600 wall access cover.
- 2.2 FLOOR DRAINS

Α.

- Cast-Iron Floor Drains: Refer to Drawings and Schedules.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.6.3.
 - 3. Description: Two-piece body with double drainage flange, adjustable strainer, and trap.
 - 4. Pattern: Floor drain.
 - 5. Body Material: Coated cast iron.
 - 6. Seepage Flange: Required.
 - 7. Anchor Flange: Required.
 - 8. Outlet: Bottom.
 - 9. Flashing Collar: Required.
 - 10. Top of Strainer Body and Finish: Nickel bronze or as indicated on drawings.
 - 11. Frame and Drain Shape:
 - a. Round.
 - b. Square for ceramic tile floors and where indicated on the Drawings.
 - Top Loading Classification: Light Duty.
 - 13. Funnel: Funnel-type strainer where indicated.
 - 14. Trap Material: Cast iron.
 - 15. Trap Pattern: Standard P-trap.
 - 16. Example: Jay R. Smith 2010-NB.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Sleeve Flashing Device:

12.

- 1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch (25 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
- 2. Size: As required for close fit to riser or stack piping.
- B. Stack Flashing Fittings:
 - 1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.
- C. Frost-Resistant Vent Terminals:
 - 1. Description: Manufactured or shop-fabricated assembly constructed of copper, leadcoated copper, or galvanized steel.

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- 2. Design: To provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.
- D. Roof Flashing Assemblies: Manufactured assembly made of 6-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counter flashing fitting.
 - 1. Manufacturers:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - 2. Open-Top Vent Cap: Without cap.
 - 3. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - 4. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 FLASHING MATERIALS

- A. Roofing and flashing materials are specified in Division 07 Sections.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, millphosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 60-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.
- H. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- I. Solder: ASTM B 32, lead-free alloy.
- J. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- B. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- C. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- D. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- F. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

- G. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- H. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."

3.3 FLASHING INSTALLATION

- A. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- B. Set flashing on floors and roofs in solid coating of bituminous cement.
- C. Secure flashing into sleeve and specialty clamping ring or device.
- D. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

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SECTION 22 33 00 WATER HEATER (ON DEMAND)

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Removal of the existing hot water heater and installation of service valve kit, neutralizer kit and on demand water heater.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
 - A. Product must meet following minimum requirements:
 - 1. A.O Smith Model CT-199i-N or equivalent
 - i. Contractor is responsible for submitting all necessary documentation, highlighting specific sections to prove equivalent, and obtaining approval prior to submitting a bid.
 - 2. 199,000 BTU
 - 3. 120 v
 - 4. Complies with Ultra-Low NOx regulations
 - 5. Energy efficiency 95% minimum
 - 6. Manufacturer warranty for commercial application:
 - i. 5 year limited warranty parts.
 - ii. 6 year warranty on heat exchanger.
 - 7. Natural gas Fuel
 - 8. Primary heat exchanger HRS35 Copper Alloy
 - 9. Secondary heat exchanger stainless steel
 - 10. Linkable up to 4 units.
 - 11. Commercial Remote Temperature Control
 - 12. 10 Maximum GPM
 - B. Accessories
 - 1. Piping and valves Shall be sized and installed in accordance with manufacturer's recommendations and all applicable codes.
 - 2. Contractor shall plumb new water heater with maintenance valves and connections for routine flushing of water heater.

2.2 SUBMITTALS

- A. Shop drawings in accordance with Section 01 33 23 Shop Drawings Product Data and Samples.
 - 1. Manufacturer's proof of meeting or exceeding all specifications.
- B. Operation and Maintenance Manuals
 - 1. Provide three (3) hard copies and one electronic copy in PDF format of warranty paperwork.
 - 2. Product Data: Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
 - d. Troubleshooting
 - e. Maintenance requirements
 - 3. Summary table of all warranties including manufacturer's extended warranties and contact information
 - 4. Warranty certificates for each piece of equipment.
- 2.3 PROJECT CONDITIONS
 - A. Contractor responsible for all electrical requirements of system.
 - B. Contractor responsible for all wall and roof penetrations required.
 - C. Contractor responsible for all plumbing connections.
 - D. Contractor responsible for all gas connections.

SECTION 22 33 00 WATER HEATER (ON DEMAND)

2.5 WARRANTY

- A. Warranty Period in addition to manufacturer's warranty: Contractor 100% responsible for one year from date of Substantial Completion, provide (3) copies signed certificate of warranty to owner.
- B. Contractor to register the system with manufacturer and provide proof of registration.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine existing conditions to ensure product fit and installation requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installation.
- B. Contractor to remove and dispose of, off camp, existing water heater and associated plumbing connections.
- C. Contractor to install water heaters to the wall at existing water heater location.
- D. Contractor to include and install service valve kit on both water inlet and discharge lines for each water heater.
- E. Contractor responsible for all electrical, gas, and plumbing requirements.

3.3 Startup & Testing

- A. Contractor to conduct unit startup and test for proper operation.
- B. Provide startup reports with O&M Manuals.

END OF SECTION 22 33 00

SECTION 22 40 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing fixtures and related components.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Hand Sinks: NSF 2 construction.
 - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - 3. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
 - 4. Vitreous-China Fixtures: ASME A112.19.2M.
 - 5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 6. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.

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- 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
- 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
- 4. Faucet Hose: ASTM D 3901.
- 5. Faucets: ASME A112.18.1M.
- 6. Hose-Connection Vacuum Breakers: ASSE 1011.
- 7. Hose-Coupling Threads: ASME B1.20.7.
- 8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
- 9. NSF Materials: NSF 61.
- 10. Pipe Threads: ASME B1.20.1.
- 11. Supply and Drain Fittings: ASME A112.18.1M.
- I. Comply with the following applicable standards and other requirements specified for bathtub and shower faucets:
 - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - 3. Faucets: ASME A112.18.1M.
 - 4. Hand-Held Showers: ASSE 1014.
 - 5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Manual-Control Antiscald Faucets: ASTM F 444.
 - 8. Pipe Threads: ASME B1.20.1.
 - 9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 - 10. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1M.
 - 3. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Floor Drains: ASME A112.21.1M.
 - 2. Grab Bars: ASTM F 446.
 - 3. Hose-Coupling Threads: ASME B1.20.7.
 - 4. Off-Floor Fixture Supports: ASME A112.6.1M.
 - 5. Pipe Threads: ASME B1.20.1.
 - 6. Plastic Toilet Seats: ANSI Z124.5.
 - 7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following.

- 1. China Kohler, American Standard, Sloan, Zurn.
- 2. Seats Beneke, Bemis, Church, Centoco, Kohler.
- 3. Faucets Zurn, Chicago, Sloan, Delta, Kohler
- 4. Shower Valves Speakman, Symmons, Powers, Delta, Kohler
- 2.2 GENERAL

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- A. The exposed flush, waste, and supply pipes at the fixtures shall be chromium-plated brass pipe, iron pipe size. Fittings and traps for brass pipe shall be cast brass, chromium-plated.
- B. Install chromium-plated brass or stainless steel wall or floor plates with set screw where piping passes through walls or floors.
- C. Where reference is made to chromium-plated brass, same shall mean polished brass, first nickel-plated and finished with chromium plate.
- D. Provide faucets, stops, and traps for all fixtures and equipment.
- E. All lavatories and drinking fountains shall be furnished with 3/8-inch SPS flexible tube supply pipes, 1/2" x 3/8" quarter turn stops and escutcheons, unless specified otherwise.
- F. All lavatories, drinking fountains, and sinks shall be furnished with 1 1/4-inch tailpiece, 1 1/2inch cast brass chrome-plated "P" trap with C.O. (1 ¹/₄" "P" trap acceptable for bathrooms lavatories), 17 gauge tubing waste to wall and escutcheons, unless otherwise specified.
- G. All fixtures fitted to the walls or floor shall be ground square and true and be sealed with a nonhardening white silicon caulk bead, with Engineer's approval.
- H. Provide Wade, Zurn, J.R. Smith, or Josam carriers or wall hangers, specified below, to support all wall hung fixtures independent of wall. Carriers shall be secured to structural floor slab with anchor bolts. Carriers shall be designed for chase space allowed on architectural plans.
 - 1. Water Closet. Short foot supports, integral stack fitting, auxiliary inlets and vent connections as required, adjustable to mounting heights indicated. Carriers for single water closets shall have an anchor foot on the back side of carrier in addition to foot supports.
 - 2. Wall hung sinks, urinals. Floor mounted, chrome fixture bolts, hanger and bearing plates for attaching upper back cast iron wall hanger brackets and lower backbolts, etc., steel pipe uprights with block bases.
 - 3. Lavatories (institutional). Floor mounted, chrome fixture bolts, hanger and bearing plates for attaching upper back cast iron wall hanger brackets and lower backbolts, etc., steel pipe uprights with block bases.
- I. The schedule on the drawings establishes the standards to which each type of fixture must conform, and the plumbing fixture portfolios shall completely illustrate and describe each type. Refer to the drawings for exact quantities of fixtures scheduled in the following. Verify mounting heights from Architectural Details.
- 2.3 FIXTURES
 - A. See the Schedule on the Plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water, waste, and vent piping systems. Verify support types, sizes, and actual locations match those required. Verify actual locations and sizes of piping connections before plumbing fixture installation. Use manufacturer's roughing-in data for fixtures provided.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

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- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 22 Section "General Duty Valves for Plumbing Piping" for general-duty valves.
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
- Q. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install escutcheons at piping wall or ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- E. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- 3.4 FIELD QUALITY CONTROL
 - A. Verify that installed fixtures are categories and types specified for locations where installed.
 - B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
 - C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

SECTION 22 40 00 PLUMBING FIXTURES

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 22 40 00 PLUMBING FIXTURES

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SECTION 23 05 00 COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Floor plates.
 - 8. Grout.
 - 9. HVAC demolition.
 - 10. Equipment installation requirements common to equipment sections.
 - 11. Painting and finishing.
 - 12. Concrete bases.
 - 13. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

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1.5 ADDITIONAL REQUIRED DATA

A. All materials, equipment, and devices shall comply with the Infrastructure and Investment and Jobs Act – Title IX Build America, Buy America (BABA). Submittals shall indicate compliance with BABA requirements. Reference Section 01 33 23 "Shop Drawing Product Data and Samples" for additional information.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- C. Materials and equipment stored on the site shall have protective covering to prevent damage and to prevent entrance of dirt, debris, and moisture.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- 2.2 PIPE, TUBE, AND FITTINGS
 - A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
 - B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- 2.3 JOINING MATERIALS
 - A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
 - B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

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- 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Underground Piping and Smaller: Manufactured fitting or coupling.
 - 2. Underground Piping and Larger: AWWA C219, metal sleeve-type coupling.
 - 3. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC or PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 225 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

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- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 MECHANICAL SLEEVE-SEAL-SYSTEM

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Plastic. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- B. Galvanized-Steel Sheet: Round sheet metal tube closed with welded longitudinal joint. Minimum sheet metal thickness as follows:
 - 1. For sleeves 12-inches and smaller:
 - 2. For sleeves 13-inches to 16-inches:
 - 3. For sleeves 17-inches to 20-inches:
 - 4. For sleeves 20-inches and larger:
- 0.0276-inch-thickness (24-gauge).
- 0.0336-inch thickness (22-gauge).
- 0.0396-inch thickness (20-gauge).
- 0.0516-inch thickness (18-gauge).

2.8 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: , 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.9 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and setscrew fastener.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

2.10 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

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PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed. Remove any and all mechanical systems, equipment, and components that are abandoned, inactive or unused as directed by the Owner.
 - 1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible ductwork material. Ducts to be removed include ductwork, fittings, duct accessories, insulation, hangers, supports, and attachments to structure.
 - 2. Ducts to Be Abandoned in Place: Cap ducts with same or compatible ductwork material. This applies to abandoned ductwork concealed behind inaccessible finishes, unless otherwise indicated.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment to be removed includes equipment, accessories, attached piping and ductwork including hangers, supports, and attachments to structure.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes, but not less than required by the building code.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 MECHANICAL SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install mechanical sleeve-seal systems in sleeves in below grade exterior concrete walls at service piping entries into building.
- B. Install sleeves for piping that will have a mechanical sleeve-seal-system installed, size sleeves large enough to provide a 1-inch annular clear space between piping and concrete slabs and walls.

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C. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, walls, partitions, roofs, and as otherwise indicated.
- B. Sleeves are not required for core-drilled holes, except where sleeves are required to extend above the floor in wet areas.
- C. Cut sleeves to length for mounting flush with both surfaces.
 - 1. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2- inches above finished floor level.
- D. Install sleeves in new above ground concrete floors, concrete roof slabs, and concrete walls as they are constructed. Cut sleeves into existing floors, roof slabs and walls.
- E. For sleeves cut into floors, roof slabs, and walls, use grout to seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- F. Install sleeves for pipes passing through concrete and masonry walls, and gypsum-board walls that are fire- and/or smoke-rated.
- G. Install sleeves that are large enough to provide 1/4-inch to 1/2-inch annular clear space between sleeve and pipe or pipe insulation.
- H. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- I. Fire- and/or Smoke-Barrier Penetrations: Maintain indicated fire- and smoke- rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.5 ESCUTCHEON AND FLOOR PLATE 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 piping and with OD that completely covers opening.
 - Escutcheons for New or Existing Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type with polished, chrome-plated finish and setscrew fastener.
 - 2. Chrome-Plated Piping: One-piece, cast-brass with polished chrome-plated finish and setscrew fastener, or split-casting type with polished chrome-plated finish and concealed hinge and setscrew fastener.
 - 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass with polished chrome-plated finish and setscrew fastener, or split-casting type with polished chrome-plated finish and concealed hinge and setscrew fastener.
 - 4. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass with polished chrome-plated finish and setscrew fastener, or split-casting type with polished chrome-plated finish and concealed hinge and setscrew fastener.
 - 5. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass with polished chromeplated finish and setscrew fastener, or split-casting type with polished chrome-plated finish and concealed hinge and setscrew fastener.
- 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.

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3.6 SLEEVE AND MECHANICAL SLEEVE-SEAL SCHEDULE

- Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls below Grade:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve with mechanical sleeveseal.
 - b. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing mechanical sleeve-seal system.
 - 2. Concrete Slabs-on-Grade:

Α.

- a. All Piping Sizes: No pipe sleeve or mechanical sleeve seal, unless otherwise indicated. Pour concrete slab around piping. Seal annular space with a waterproofing sealer.
- 3. Exterior Concrete Walls above Grade:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve. No mechanical sleeve seal is required, unless otherwise indicated. Seal annular space with a waterproofing sealer.
- 4. Concrete Slabs above Grade:
 - a. Cast-iron or galvanized-steel pipe sleeve. No mechanical sleeve seal is required, unless otherwise indicated. Seal annular space with a waterproofing sealer.
- 5. Interior Concrete or Masonry Walls:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- 6. Interior Gypsum-Board Walls that are Fire- and/or Smoke-Rated:
 - a. All Piping Sizes: Cast-iron or galvanized-steel pipe sleeve.
 - b. Galvanized Sheet Metal Sleeves may be used for all pipe sizes penetrating gypsum-board partitions.
- 7. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.7 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using leadfree solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

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- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.8 PIPING CONNECTIONS

A. 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. Dry Piping Systems: Install dielectric unions and dielectric flanges to connect piping materials of dissimilar metals.
- 4. Wet Piping Systems: Install dielectric unions and dielectric flanges, or to connect piping materials of dissimilar metals.

3.9 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.
- B. Verify final equipment locations for roughing-in.
- C. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- E. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- F. Install equipment to allow right of way for piping installed at required slope.

3.10 PAINTING

- A. Remove markings, stickers, tags, lubricants, protective oils, and other substances and repair damaged surfaces of equipment, piping, ductwork that will be exposed to view in finished spaces. Clean and prepare surfaces that are specified to be finish painted.
- B. Painting of HVAC systems, equipment, and components, if any, is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
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3.11 CONCRETE BASES

- A. Concrete Bases and Curbs: Cast-in-place bases and curbs are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate sizes and locations, and provide attachments as follows;
 - 1. Provide scaled layouts of bases and curbs with sizes and locations dimensioned to concrete walls and columns.
 - 2. Determine base and curb size based on purchased equipment shop drawings. Base sizes and locations shall not be scaled from Drawings.
 - 3. Construct concrete bases of dimensions indicated, but not less than 4-inches larger in both directions than supported unit.
- B. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
- C. C.Construction Details: If not detailed in Division 03, provide the following:Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.12 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.13 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.14 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 23 05 00

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SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor Controllers: Variable frequency drives.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Comply with NEMA MG 1 unless otherwise indicated.
 - 2. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium-efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

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2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by variable frequency drive supplier.
 - 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.
- C. Bearing Protection Rings for Motors Used with Variable Frequency Drives: Provide conductive microfiber motor shaft grounding rings to prevent damage to motor bearings by safely discharging static electrical charges to ground. Bearing protection rings shall be equivalent to Aegis SCR Bearing Rings.
- D. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ECM MOTORS

Where indicated motors shall be Electronically Commutated Motor, ECM, variable-speed, DC, Α. brushless motors specifically designed for use with single phase, 60 hertz electrical input. Motor shall be complete with and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Motor rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in soft start and soft speed change ramps. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motor shall be direct coupled to the driven equipment. Motor shall maintain a minimum of 70% efficiency over its entire operating range. Provide manual or remote motor speed output control for field adjustment of the motor speed setpoint. Inductors shall be provided to minimize harmonic distortion and line noise. Provide isolation between fan motor assembly and driven equipment to eliminate any vibration Provide a motor that is designed to overcome reverse rotation and not affect life expectancy. Manufacturer shall provide a factory installed Pulse Width Modulation, PWM, controller for either manual or DDC controlled speed adjustment. The manual PWM controller shall be field adjustable with a standard screwdriver. The remote PWM controller shall be capable of receiving a 0-10 Vdc signal from the DDC controller (provided by the controls contractor) to control the motor speed.

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING, DUCTWORK, 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. Pipe labels.
 - 3. Duct labels.
 - 4. Valve tags.
 - 5. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 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.

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING, DUCTWORK, AND EQUIPMENT

- 2. Lettering Size: At least 1-1/2 inches high.
- 2.3 DUCT LABELS
 - A. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
 - B. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, 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.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- 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: Approximately 4 by 7 inches.
 - 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. Pipe Labels: Install pipe labels on each piping system. Include arrows showing normal direction of flow. Provide manufactured self-adhesive plastic labels or provide stenciled labels.
- B. 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.

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING, DUCTWORK, AND EQUIPMENT

- 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.

3.4 DUCT LABEL INSTALLATION

- A. Duct Labels: Install duct labels on each duct system. Include arrows showing normal direction of flow. Provide manufactured self-adhesive plastic labels or provide stenciled labels.
- 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.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
 - 1. Valve-Tag Schedule: Provide a Valve-tag schedule in operation and maintenance data.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING, DUCTWORK, AND EQUIPMENT

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SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.3 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.

1.4 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. Certified TAB reports.
- C. Sample report forms.
- D. 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.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. TAB Conference: Meet with Engineer and Owner on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide ten days' advance notice of scheduled meeting time and location.
 - 1. Ågenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. 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.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer and Owner.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing."
- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 "System Balancing."

1.6 COORDINATION

- A. Notice: Provide seven days' advance notice for each test to the Engineer and Owner. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- PART 2 PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 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, balancing valves and fittings, 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 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.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. 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.
- I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- 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.

3.2 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.

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- 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.

3.3 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" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing."
- B. Cut insulation, ducts, pipes, 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 Division 23 Section "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section insulation sections.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, 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.

3.4 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 exhaustair 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.

3.5 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.

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- 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. 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.
- 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fanmotor 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.

3.6 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.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.8 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 .

SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

3.9 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

Β.

C.

- 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.
 - 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.
 - 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-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. 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. Furnace Test Reports: For furnaces with heat exchangers and DX coils, include the following:
 - 1. Unit Data:
 - a. Unit identification.

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- 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. 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.
- 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm. (L/s)
 - b. Total system static pressure in inches wg. (Pa)
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg. (Pa)
 - e. Filter static-pressure differential in inches wg. (Pa)
 - f. Cooling-coil static-pressure differential in inches wg. (Pa)
 - g. Heat Exchanger static-pressure differential in inches wg. (Pa)
 - h. Outdoor airflow in cfm. (L/s)
 - i. Return airflow in cfm. (L/s)
 - j. Outdoor-air damper position.
 - k. Return-air damper position.
- F. Apparatus-Coil Test Reports:
 - 1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Make and model number.
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm. (L/s)
 - b. Average face velocity in fpm. (m/s)
 - c. Air pressure drop in inches wg. (Pa)
 - d. Entering-air, wet- and dry-bulb temperatures in deg F. (deg C)
 - e. Leaving-air, wet- and dry-bulb temperatures in deg F. (deg C)
 - f. Refrigerant expansion valve and refrigerant types.
 - g. Refrigerant suction pressure in psig. (kPa)
 - h. Refrigerant suction temperature in deg F. (deg C)
- G. 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. (kW)
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.

SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

- Motor full-load amperage and service factor. Ι. 2.
 - Test Data (Indicated and Actual Values):
 - Total air flow rate in cfm. (L/s) a.
 - Entering-air temperature in deg F. (deg C) b.
 - Leaving-air temperature in deg F. (deg C) C.
 - Air temperature differential in deg F. (deg C) d.
- Fan Test Reports: For exhaust fans, include the following: H.
 - 1. Fan Data:
 - System identification. a.
 - Location. b.
 - Make and type. C.
 - Model number and size. d.
 - Manufacturer's serial number. e.
 - f. Arrangement and class.
 - 2. Motor Data:
 - Motor make, and frame type and size. a.
 - Horsepower and rpm. b.
 - Volts, phase, and hertz. c.
 - Full-load amperage and service factor. d.
 - Test Data (Indicated and Actual Values): 3.
 - Total airflow rate in cfm. (L/s) a.
 - b. Total system static pressure in inches wg. (Pa)
 - c. Fan rpm.
- I. Instrument Calibration Reports:
 - Report Data: 1.
 - Instrument type and make. a.
 - Serial number. b.
 - Application. c.
 - d. Dates of use.
 - e. Dates of calibration.

INSPECTIONS 3.11

- Α. 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:
 - Measure airflow of at least 10 percent of air outlets. a.
 - Measure room temperature at each thermostat/temperature sensor. Compare the b. reading to the set point.
 - Verify that balancing devices are marked with final balance position. c.
 - d. Note deviations from the Contract Documents in the final report.
- Β. Final Inspection:
 - After initial inspection is complete and documentation by random checks verifies that 1. testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner.
 - If rechecks yield measurements that differ from the measurements documented in the 2. final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 - 3. 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:

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- 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 23 05 93

SECTION 23 07 13 DUCT 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 duct services:
 - 1. Concealed and exposed supply-air and make-up air.
 - 2. Concealed and exposed return-air.
 - 3. Concealed and exposed, outside-air and mixed-air.
 - 4. Concealed and exposed, exhaust-air and relief-air.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Sustainable Design Submittals:
 - 1. Product Data: For Adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for lowemitting materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- 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.

1.5 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 Division 15 Section "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.
- 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.

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C. Do not store or install duct insulation materials until the building is enclosed and weather-tight. Use extra-ordinary means to keep insulation clean and dry.

PART 2 - PRODUCTS

- 2.1 INSULATION MATERIALS
 - A. Comply with requirements in "Duct Insulation Schedule, General," "Duct Insulation Schedule," and "Outdoor Duct 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 II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - F. 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, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Owens Corning; SOFTR All-Service Duct Wrap.
 - G. 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 ASJ or FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Johns Manville; 800 Series Spin-Glas.
 - c. Knauf Insulation; Insulation Board.
 - d. Owens Corning; Fiberglas 700 Series.
 - H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb./cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.
 - d. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; FlameChek.
 - b. Johns Manville; Firetemp Wrap.
 - c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.

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- d. Thermal Ceramics; FireMaster Duct Wrap.
- e. 3M; Fire Barrier Wrap Products.
- 2.3 ADHESIVES
 - A. Adhesives shall have a VOC content of 50 g/L or less.
 - B. Adhesives shall comply with the testing and product requirements of California Department of Public Health's "Standard for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", Version 1.1.
 - C. 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.
 - D. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - F. 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, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - G. PVC Jacket Adhesive: Compatible with PVC jacket. 1. Products: Subject to compliance with requirem
 - Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. Speedline Corporation; Polyco VP Adhesive.

2.4 MASTICS

- A. Mastic coatings shall have a VOC content of 100 g/L or less.
- B. Mastic coatings shall comply with the testing and product requirements of California Department of Public Health's "Standard for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", Version 1.1.
- C. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- D. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - 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.
- E. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.

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- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
- 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
- 3. Service Temperature Range: 0 to 180 deg F.
- Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 Color: White.
- F. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 - 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.
 - Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 Color: White.
- G. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - 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.

2.5 LAGGING ADHESIVES

- A. Lagging Adhesives shall have a VOC content of 50 g/L or less.
- B. Lagging Adhesives shall comply with the testing and product requirements of California Department of Public Health's "Standard for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", Version 1.1.
- C. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over duct insulation.
 - 3. Service Temperature Range: 0 to plus 180 deg F.
 - 4. Color: White.
- 2.6 SEALANTS
 - A. Sealants shall have a VOC content of 420 g/L or less.
 - B. Sealants shall comply with the testing and product requirements of California Department of Public Health's "Standard for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", Version 1.1.
 - C. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.

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- 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.
- D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of 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.

2.7 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.
- B. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white or stucco-embossed aluminum-foil facing.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Polyguard Products, Inc.; Alumaguard 60.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.

2.9 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, provide one of 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 lb. force/inch in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

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- 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, provide one of 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 lb. force/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, provide one of 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 lb. force/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lb. force/inch in width.

2.10 SECUREMENTS

- A. Bands:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide.
 - 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide.
- B. Insulation Pins and Hangers:
 - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, of diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.

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- 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, of 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, provide one of the following:
 1) AGM Industries, Inc.; CWP-1.
 - AGM Industries, I
 GEMCO: CD.
 - 2) GEMCO; CD. 2) Midwost Eastonors
 - Midwest Fasteners, Inc.; CD.
 Nelson Stud Welding; TPA, TPC, and TPS.
- Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
- 2.11 CORNER ANGLES
 - A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
 - B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.
- PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, 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.

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- 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.
 - 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.

3.4 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 below roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.

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- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 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 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 vaporbarrier seal.
 - 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.

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- 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, 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 vaporbarrier seal.
 - 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.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with overlap at seams and joints.
 - 2. Embed glass cloth between two thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
 - Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with laps at longitudinal seams and wide joint strips at end joints.

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SECTION 23 07 13 DUCT INSULATION

- 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with Manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- E. Install self-adhesive outdoor jacket (Alumagard 60) in accordance with the manufacturer's recommendations to achieve a watertight installation.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.8 FINISHES

A. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. The Architect may inspect ductwork insulation by directing removal of field-applied jacket and insulation in layers in reverse order of their insulation. The extent of inspection shall be as required to determine compliance with requirements. Re-insulation shall be completed at the Contractor's expense.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Ducts Requiring Insulation:
 - 1. Concealed and exposed supply-air.
 - 2. Concealed and exposed, outside-air and mixed-air.
 - 3. 15'-0" from exterior penetration, exhaust-air.
- B. Items Not Insulated:
 - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 2. Concealed and exposed return-air.
 - 3. Concealed and exposed, exhaust-air.
 - 4. Factory-insulated flexible ducts.
 - 5. Factory-insulated plenums and casings.
 - 6. Flexible connectors.
 - 7. Vibration-control devices.
 - 8. Factory-insulated access panels and doors.

3.11 INDOOR DUCT INSULATION SCHEDULE

- A. Supply and Ventilation Air Ducts: Round, concealed and exposed, other than factory insulated double wall ducts.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 1-1/2 inches.
 - 3. Number of Layers: One.

SECTION 23 07 13 DUCT INSULATION

- 4. Field-Applied Jacket: Foil and paper.
- 5. Vapor Retarder Required: Yes.
- 6. Density: 1 lb.
- 7. R-Value: 5.6.
- B. Supply and Ventilation Air Ducts: Rectangular, concealed and exposed:
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 1-1/2 inches.
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
 - 6. Density: 1 lb.
 - 7. R-Value: 5.6.
- C. Ventilation Air and Exhaust Air Ducts routed in Attic Spaces: Rectangular, concealed and exposed:
 - 1. Material: Mineral-fiber board.
 - 2. Thickness: 2 inches.
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
 - 6. Density: 3 lb.
 - 7. R-Value: 8.7.
- D. Outside Air Ducts: Rectangular, concealed and exposed:
 - 1. Material: Mineral-fiber board.
 - 2. Thickness: 2 inches.
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
 - 6. Density: 3 lb.
 - 7. R-Value: 8.7.
- E. Outside Air Ducts: Round, concealed and exposed:
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 2 inches.
 - 3. Number of Layers: One.
 - 4. Field-applied Jacket: Glass cloth.
 - 5. Vapor Retarder Required: Yes.
 - 6. Density: 1-1/2 lb.
 - 7. R-Value: 8.7.
- F. Mixed air ducts: Rectangular exposed
 - 1. Material: Mineral-fiber board.
 - 2. Thickness: 1 inch.
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and Paper
 - 5. Vapor Retarder Required: Yes.
 - 6. Density: 1-1/2 lb.
 - 7. R-Value: 4.3.

END OF SECTION 23 07 13

SECTION 23 11 20 FACILITY GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

This specification section applies to gas piping installed within buildings incidental underground piping under building, above ground steel piping and corrugated stainless-steel tubing (CSST) both outside (up to 5 feet beyond exterior walls) and within buildings in compliance with NFPA 54/AGA Z223.1, "National Fuel Gas Code" NFPA 58, "Fuel Gas Piping".

1.2 SYSTEM DESCRIPTION

The gas piping system includes natural gas piping and appurtenances from point of connection with supply system, as indicated, to gas operated equipment within the facility.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN GAS ASSOCIATION (AGA)		
AGA ANSI B109.1	Diaphragm Type Gas Displacement Meters (Under 500 cubic	
	ft./hour Capacity)	
AGA ANSI B109.2	Diaphragm Type Gas Displacement Meters (500 cubic ft./hour	
	Capacity and Over)	
AGA ANSI B109.3	Rotary-Type Gas Displacement Meters	
AGA ANSI B109.4	Self-Operated Diaphragm-Type Natural Gas Service Regulators	
	for Nominal Pipe Size 1¼ inches (32 mm) and Smaller with	
	Outlet Pressures of 2 psig (13.8 kPa) and Less	
AGA XR0603	AGA Plastic Pipe Manual for Gas Service	
AGA Z223.1	National Fuel Gas Code AMERICAN NATIONAL STANDARDS	
	INSTITUTE (ANSI)	
ANSI Z21.1/CSA 1.1	Household Cooking Gas Appliances	
ANSI Z21.15/CSA 9.1	Manually Operated Gas Valves for Appliances, Appliance	
	Connector Valves and Hose End Valves	
ANSI Z21.18/CSA 6.3	Gas Appliance Pressure Regulators	
ANSI Z21.21/CSA 6.5	Automatic Valves for Gas Appliances ANSI Z21.24/CSA 6.10	
	Connectors for Gas Appliances	
ANSI Z21.41/CSA 6.9	Quick-Disconnect Devices for Use with Gas Fuel Appliances	
ANSI Z21.69/CSA 6.16	Connectors for Movable Gas Appliances	
ANSI Z21.78/CSA 6.20	Standard Specification for Combination Gas Controls for Gas	
	Appliances	
ANSI Z21.80/CSA 6.22	Line Pressure Regulators	
ANSI Z21.93/CSA 6.30	Excess Flow Valves for Natural Gas and Propane Gas with	
	Pressures up to 5 psig	
AMERICAN PETROLEUM INSTITUTE (API)		
API 570	Piping Inspection Code: In-Service Inspection, Rating, Repair,	
	and Alteration of Piping Systems	
API MPMS 2.2A	Manual of Petroleum Measurement Standards Chapter 2-Tank	
	Calibration Section 2A-Measurement and Calibration of Upright	
	Cylindrical Tanks by the Manual Tank Strapping Method	
API MPMS 2.2E	Petroleum and Liquid Petroleum Products - Calibration of	
	Horizontal Cylindrical Tanks - Part 1: Manual Methods	
API RP 1110	Recommended Practice for the Pressure Testing of Steel	
	Pipelines for the Transportation of Gas, Petroleum Gas,	
	Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide	
API RP 2003	Protection Against Ignitions Arising out of Static, Lightning, and	
	Stray Currents	

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API RP 2009	Safe Welding, Cutting, and Hot Work Practices in Refineries, Gasoline Plants, and Petrochemical Plants	
API Spec 5CT	Casing and Tubing	
API Spec 6D	Specification for Pipeline and Piping Valves	
API Spec 15LR	Specification for Low Pressure Fiberglass Line Pipe	
API Std 598	Valve Inspecting and Testing	
API Std 607	Fire Test for Quarter-turn Valves and Valves Equipped with Non-	
	metallic Seats	
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)		
ASCE 25-16	Earthquake-Activated Automatic Gas Shutoff Devices	
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)		
	Scheme for the identification of Piping Systems	
ASME B1 20 1	Dinied Inch Screw Threads (UN and UNK Thread Form)	
ASME B16 1	Grav Iron Ding Elanges and Elanged Eittings Classes 25, 125	
ASME B10.1	and 250	
ASME B16.3	Malleable Iron Threaded Fittings, Classes 150 and 300	
ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24	
	Metric/Inch Standard	
ASME B16.9	Factory-Made Wrought Buttwelding Fittings	
ASME B16.11	Forged Fittings, Socket-Welding and Threaded	
ASME B16.21	Nonmetallic Flat Gaskets for Pipe Flanges	
ASME B16.33	Manually Operated Metallic Gas Valves for Use in Gas Piping	
	Systems Up to 125 psi, (Sizes NPS 1/2 - NPS 2)	
ASME B16.39	Standard for Malleable Iron Threaded Pipe Unions; Classes 150,	
	250, and 300	
ASME B18.2.1	Square and Hex Bolts and Screws (Inch Series)	
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex,	
	Square, Hex Flange, and Coupling Nuts (Inch Series)	
ASME B31.8	Gas Transmission and Distribution Piping Systems	
ASME B31.9	Building Services Piping	
ASME B36.10M	Welded and Seamless Wrought Steel Pipe	
ASME BPVC SEC IX	BPVC Section IX-Welding, Brazing and Fusing Qualifications	
ASME BPVC SEC VIII D1	BPVC Section VIII-Rules for Construction of Pressure Vessels	
	Division 1	
AMERICAN WELDING SOCIETY (AWS)		
AWS A5.8/A5.8M	Specification for Filler Metals for Brazing and Braze Welding	
AWS WHB-2.9	Welding Handbook; Volume 2, Welding Processes, Part 1	
ASTM INTERNATIONAL (ASTM)		
ASTM 01.01	Śteel - Piping, Tubing, Fittings	
ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped,	
	Zinc-Coated, Welded and Seamless	
ASTM A105/A105M	Standard Specification for Carbon Steel Forgings for Piping	
	Applications	
ASTM A181/A181M	Standard Specification for Carbon Steel Forgings, for General-	
	Purpose Piping	
ASTM A193/A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting	
	Internals for High-Temperature Service and Other Special	
	r uipuse Applications	

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ASTM A194/A194M	Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High- Temperature Service, or Both	
ASTM A513/A513M	Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing	
ASTM A666	Standard Specification for Annealed or Cold-Worked Austenitic	
	Stainless Steel Sheet, Strip, Plate and Flat Bar	
ASTM B88	Standard Specification for Seamless Copper Water Tube	
ASTM B210/B210M	Standard Specification for Aluminum and Aluminum-Alloy Drawn	
	Seamless Tubes	
ASTM B241/B241M	Standard Specification for Aluminum and Aluminum-Alloy	
	Seamless Pipe and Seamless Extruded Tube	
ASTM B280	Standard Specification for Seamless Copper Tube for Air	
	Conditioning and Refrigeration Field Service	
ASTM D2513	Standard Specification for Polyethylene (PE) Gas Pressure Pipe,	
	Lubing, and Fittings	
ASTM D2517	Standard Specification for Reinforced Epoxy Resin Gas	
	Pressure Pipe and Fittings	
ASTM F2015	Standard Specification for Lap Joint Flange Pipe End	
	Applications	
	Fuel Cas Dining Systems Lloing Corrugated Stainlass Steel	
ANSI LC 1/CSA 6.26	Fuel Gas Piping Systems Using Corrugated Stainless Steel	
001 0 11 100	Tubing (CSST)	
CGA 3.11-M88	Lever Operated Pressure Lubricated Plug Type Gas Shut-Off	
CCA 2.16 M88	Valves	
CGA 3. 10-10188	Lever Operated Non-Lubricated Gas Shut-Oil Valves	
CGA 9.2-1088	manually Operated Shut-Oil Valves for Gas Piping Systems	
	Approval Cuido http://www.approvalguido.com/	
FIM AFF GUIDE	Approval Guide <u>http://www.approvalguide.com/</u>	
MANUEACTURERS STANDAR	DIZATION SOCIETY OF THE VALVE AND FITTINGS	
MANULAUTORERO OTANDAR		
MSS SP-25	Standard Marking System for Valves Fittings Flanges and	
MOO OF 20	Unions	
MSS SP-58	Pine Hangers and Supports - Materials Design and	
	Manufacture Selection Application and Installation	
MSS SP-83	Class 3000 Steel Pine Unions Socket Welding and Threaded	
MSS SP-86	Guidelines for Metric Data in Standards for Valves, Flanges	
	Fittings and Actuators	
	Thungs and Actuators	
NATIONAL FIRE PROTECTION	LASSOCIATION (NEPA)	
NFPA 54	National Fuel Gas Code	
NFPA 58	Liquefied Petroleum Gas Code	
NFPA 70	National Electrical Code	
N 1 / / / 0		
SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION		
	(SMACNA)	
SMACNA 1981	Seismic Restraint Manual Guidelines for Mechanical Systems	
	3rd Edition	
SOCIETY FOR PROTECTIVE COATINGS (SSPC)		

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SSPC SP 6/NACE No.3 Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD) MIL-STD-101_____Color Code for Pipelines and for Compressed Gas Cylinders UFC 3-301-01____Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA) 49 CFR 192______Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

UNDERWRITERS LABORATORIES (UL)

UL 125 UL 125 UL Standard for Safety Flow Control Valves for Anhydrous Ammonia and LP-Gas UL 842 UL Standard for Safety Valves for Flammable Fluids UL 860 Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service UL FLAMMABLE & COMBUSTIBLE Flammable and Combustible Liquids and Gases

Equipment Directory

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Shop Drawings
 - 1. Gas Piping System
- B. Product Data
 - 1. Pipe and Fittings
 - 2. Gas Equipment Connectors
 - 3. Gas Piping System
 - 4. Pipe Coating Materials
 - 5. Risers
 - 6. Transition Fittings
 - 7. Valves
 - 8. Warning and Identification Tape
- C. Test Reports
 - 1. Testing
 - 2. Pressure Tests
 - 3. Test with Gas
- D. Certificates
 - 1. Welders Procedures and Qualifications
 - 2. Assigned Number, Letter, or Symbol
- E. Manufacturer's Instructions
 - 1. PE Pipe and Fittings
 - 2. Pipe Coating Materials
- F. Operation and Maintenance Data
 - 1. Gas Facility System and Equipment Operation
 - 2. Gas Facility System Maintenance
 - 3. Gas Facility Equipment Maintenance
- G. Submit manufacturer's descriptive data and installation instructions for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Mark all valves, flanges and fittings in accordance with MSS SP-25.
- H. Welding Qualifications
 - Weld piping in accordance with qualified procedures using performance qualified welders and welding operators in accordance with API RP 2009, ASME BPVC SEC IX, and ASME B31.9. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.9. Notify the

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Contracting Officer at least 24 hours in advance of tests and perform at the work site if practicable.

- Submit a certified copy of welders procedures and qualifications metal and PE in conformance with ASME B31.9 for each welder and welding operator. Submit the assigned number, letter, or symbol that will be used in identifying the work of each welder to the Contracting Officer. Weld all structural members in accordance with Section 05 05 23.16 STRUCTURAL WELDING, and in conformance with AWS A5.8/A5.8M, and AWS WHB-2.9.
- I. Jointing Thermoplastic and Fiberglass Piping

Perform all jointing of piping using qualified joiners and qualified procedures in accordance with AGA XR0603. Furnish the Contracting Officer with a copy of qualified procedures and list of and identification symbols of qualified joiners. Submit manufacturer's installation instructions and manufacturer's visual joint appearance chart, including all PE pipe and fittings.

J. Shop Drawings

Submit drawings for complete Gas Piping System, within 30 days of contract award, showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of gas equipment connectors and supports. Include LP storage tank, pad, and mounting details.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Plastic Pipe

Handle, transport, and store plastic pipe and fittings carefully. Plug or cap pipe and fittings ends during transportation or storage to minimize dirt and moisture entry. Do not subject piping to abrasion or concentrated external loads. Discard PE pipe sections and fittings that have been damaged.

B. CSST Tubing

Handle, transport and store CSST tubing on the wooden spool or shipping container provided by the manufacturer. Insure tubing ends are capped during transportation and storage to minimize dirt and moisture entry. Discard any tubing segment and fitting that has been damaged.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos are not allowed. Submit catalog data and installation instructions for pipe, valves, all related system components, pipe coating materials and application procedures. Conform to NFPA 54NFPA 58 and with requirements specified herein. Provide supply piping to appliances or equipment at least as large as the inlets thereof.

2.2 GAS PIPING SYSTEM AND FITTINGS

- A. Steel Pipe, Joints, and Fittings
 - 1. Pipe: Black carbon steel in accordance with ASTM A53/A53M, Schedule 40, threaded ends for sizes 2 inches and smaller; otherwise, plain end beveled for butt welding.
 - 2. Threaded Fittings: ASME B16.3, black malleable iron.
 - 3. Socket-Welding Fittings: ASME B16.11, forged steel.
 - 4. Butt-Welding Fittings: ASME B16.9, with backing rings of compatible material.
 - 5. Unions: MSS SP-83ASME B16.39, black malleable iron.
 - 6. Flanges and Flanged Fittings: ASME B16.5 steel flanges or convoluted steel flanges conforming to ASME BPVC SEC VIII D1, with flange faces having integral grooves of rectangular cross sections which afford containment for self-energizing gasket material.

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- 7. Provide steel pipe conforming to ASME B36.10M; and malleable-iron threaded fittings conforming to MSS SP-86 ASME B16.1 and ASME B16.3. Provide steel pipe flanges and flanged fittings, including bolts, nuts, and bolt pattern in accordance with ASME B16.5 and ASTM A105/A105M. Provide wrought steel buttwelding fittings conforming to ASME B16.9. Provide socket welding and threaded forged steel fittings conforming to MSS SP-83 ASME B16.11 and ASTM A181/A181M, Class 60.
- B. Aluminum Alloy Pipe and Tubing, Joints, and Fittings Provide aluminum alloy pipe conforming to ASTM B241/B241M, except that alloy 5456 is not allowed. Mark the ends of each length of pipe indicating it conforms to NFPA 54 NFPA 58. Thread, flange, braze, or weld pipe joints. Provide aluminum alloy tubing conforming to ASTM B210/B210M, Type A or B, or ASTM B241/B241M, Type A or equivalent, with joints made up with gas tubing fittings recommended by the tubing manufacturer.
- C. Copper Tubing, Joints and Fittings Provide copper tubing conforming to ASTM B88M ASTM B88, Type K or L, or ASTM B280, with tubing joints made up with tubing fittings recommended by the tubing manufacturer. Provide copper and copper alloy press fittings, with sealing elements of Hydrogenated Nitrile Butadiene Rubber (HNBR), factory installed, or an alternative supplied by the fitting manufacturer.
- D. Steel Tubing, Joints and Fittings Provide steel tubing conforming to ASTM 01.01, and ASTM A513/A513M, with tubing joints made up with gas tubing fittings recommended by the tubing manufacturer.
- E. Corrugated Stainless Steel Tubing, Fittings and Accessories Provide corrugated stainless steel tubing conforming to ANSI LC 1/CSA 6.26 (austenitic stainless steel of series 300) with tubing joints made with special mechanical fittings as supplied by the tubing manufacturer.
 - 1. Tubing

Austenitic stainless alloy of series 300 with polyethylene jacket/coating in accordance with ANSI LC 1/CSA 6.26 for sizes 3/8-inch through 2-inch

2. Mechanical Fittings

Copper alloy with one end matched to the corrugated tubing and one end with NPT threads in accordance with ASME B1.20.1

3. Striker Plates

Hardened steel designed to protect tubing from mechanical damage in accordance with ANSI LC 1/CSA 6.26

- 4. Manifolds Malleable iron, steel or copper alloy with threaded connections/ports in accordance with ASME B1.20.1
- F. Sealants for Steel Pipe Threaded Joints

Provide joint sealing compound as listed in UL FLAMMABLE & COMBUSTIBLE, Class 20 or less. For taping, use tetrafluoroethylene tape conforming to UL FLAMMABLE & COMBUSTIBLE.

G. Warning and Identification

Provide pipe flow markings, warning and identification tape, and metal tags as required. H. Flange Gaskets

Provide gaskets of non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type, containing aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 600 degree F service, to be used for hydrocarbon service.

- I. Pipe Threads Provide pipe threads conforming to ASME B1.20.2MASME B1.20.1.
- J. Escutcheons Provide chromium-plated steel or chromium-plated brass escutcheons, either one piece or split pattern, held in place by internal spring tension or set screw.
- K. Gas Transition Fittings
- 1. Provide steel to plastic (PE) designed for steel-to-plastic with tapping tee or sleeve conforming to AGA XR0603 requirements for transitions fittings. Coat or wrap exposed steel pipe with heavy plastic coating.
- Plastic to Plastic: Manufacturer's standard bolt-on (PVC to PE) plastic tapping saddle tee, UL listed for gas service, rated for 100 psig, and O-ring seals OR Manufacturer's standard slip-on PE mechanical coupling, molded, with stainless-steel ring support conforming to ASTM A666, O-ring seals, and rated for 150 psig gas service. OR Manufacturer's standard fused tapping (PE-to-PE) tee assembly with shut-off feature.
- Provide lever operated pressure lubricated plug type gas shut-off valve conforming to CGA 3.11-M88 OR Provide lever operated non-lubricated gas shut-off valves conforming to CGA 3.16-M88 OR Provide manually operated shut-off valve conforming to CGA 9.2-M88.
- L. Insulating Pipe Joints
 - 1. Insulating Joint Material Provide insulating joint material between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.
 - Threaded Pipe Joints Provide threaded pipe joints of steel body nut type dielectric unions with insulating gaskets.
 - 3. Flanged Pipe Joints

Provide joints for flanged pipe consisting of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts.

- M. Flexible Connectors
 - Provide flexible connectors for connecting gas utilization equipment to building gas piping conforming to ANSI Z21.24/CSA 6.10 or ANSI Z21.41/CSA 6.9 for quick disconnect devices, and flexible connectors for movable food service equipment conforming to ANSI Z21.69/CSA 6.16. Provide combination gas controls for gas appliances conforming to ANSI Z21.78/CSA 6.20.
 - 2. Do not install the flexible connector through the appliance cabinet face. Provide rigid metallic pipe and fittings to extend the final connection beyond the cabinet, except when appliance is provided with an external connection point.

2.3 VALVES

Provide lockable shutoff or service isolation valves as indicated in the drawings conforming to the following:

- A. Valves 2 Inches and Smaller Provide valves 2 inches and smaller conforming to ASME B16.33 of materials and manufacture compatible with system materials used. Provide manually operated household cooking gas appliance valves conforming to ANSI Z21.1/CSA 1.1 and ANSI Z21.15/CSA 9.1.
- B. Valves 2-1/2 Inches and Larger Provide valves 2-1/2 inches and larger of carbon steel conforming to API Spec 6D, Class 150.
- C. Valve Support on PE Piping Provide valve support assembly in accordance with the PE piping manufacturer's requirements at valve terminations points.
- 2.5 PIPE HANGERS AND SUPPORTS Provide pipe hangers and supports conforming to MSS SP-58.
- 2.6 LINE AND APPLIANCE REGULATORS AND SHUTOFF VALVES Provide regulators conforming to ANSI Z21.18/CSA 6.3 for appliances, or ANSI Z21.78/CSA 6.20 for combination gas controls for gas appliances, and ANSI Z21.80/CSA 6.22 for line pressure regulators. Provide shutoff valves conforming to ANSI Z21.15/CSA 9.1 for manually controlled

SECTION 23 11 20 FACILITY GAS PIPING

gas shutoff valves and ANSI Z21.21/CSA 6.5 for automatic shutoff valves for gas appliances.

2.9 BOLTING (BOLTS AND NUTS)

Stainless steel bolting; ASTM A193/A193M, Grade B8M or B8MA, Type 316, for bolts; and ASTM A194/A194M, Grade 8M, Type 316, for nuts. Dimensions of bolts, studs, and nuts must conform with ASME B18.2.1 and ASME B18.2.2 with coarse threads conforming to ASME B1.1, with Class 2A fit for bolts and studs and Class 2B fit for nuts. Bolts or bolt-studs must extend through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Bolts must have American Standard regular square or heavy hexagon heads; nuts must be American Standard heavy semifinished hexagonal.

2.10 GASKETS

Fluorinated elastomer, compatible with flange faces.

2.11 IDENTIFICATION FOR ABOVEGROUND PIPING

MIL-STD-101 for legends and type and size of characters. For pipes 3/4 inch od and larger, provide printed legends to identify contents of pipes and arrows to show direction of flow. Color code label backgrounds to signify levels of hazard. Make labels of plastic sheet with pressure-sensitive adhesive suitable for the intended application. For pipes smaller than 3/4 inch od, provide brass identification tags 1 1/2 inches in diameter with legends in depressed black-filled characters.

PART 3 - EXECUTION

3.1 EXAMINATION After becoming familiar with all details of the work, ve

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy or areas of conflict before performing the work.

3.2 EXCAVATION AND BACKFILLING Provide required excavation, backfilling, and compaction as

Provide required excavation, backfilling, and compaction as specified in Section 31 00 00 EARTHWORK.

3.3 GAS PIPING SYSTEM

Provide a gas piping system from the point of delivery, defined as the outlet of the service regulator, as specified under "Gas Service" within this specification, to the connections to each gas utilization device that is in compliance with NFPA 54.

A. Protection and Cleaning of Materials and Components

Protect equipment, pipe, and tube openings by closing with caps or plugs during installation. At the completion of all work, thoroughly clean the entire system.

B. Workmanship and Defects

Piping, tubing and fittings must be clear and free of cutting burrs and defects in structure or threading and must be thoroughly brushed and chip-and scale-blown. Repair of defects in piping, tubing or fittings is not allowed; replace defective items when found.

3.4 PROTECTIVE COVERING

- A. Aboveground Metallic Piping Systems
 - 1. Ferrous Surfaces

Touch up shop primed surfaces with ferrous metal primer. Solvent clean surfaces that have not been shop primed. Mechanically clean surfaces that contain loose rust, loose mill scale and other foreign substances by power wire brushing or commercial sand blasted conforming to SSPC SP 6/NACE No.3 and prime with ferrous metal primer or vinyl type wash coat. Finish primed surfaces with two coats of exterior vinyl paint.

2. Nonferrous Surfaces Except for aluminum alloy pipe, do not paint nonferrous surfaces. Paint surfaces of

aluminum alloy pipe and fittings to protect against external corrosion where they contact masonry, plaster, insulation, or are subject to repeated wettings by such liquids as water, detergents or sewage. Solvent-clean the surfaces and treat with vinyl type wash coat. Apply a first coat of aluminum paint and a second coat of alkyd gloss enamel or silicone alkyd copolymer enamel.

3.5 INSTALLATION

Install the gas system in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54 and AGA XR0603, and as indicated. Perform all pipe cutting without damage to the pipe, with an approved type of mechanical cutter, unless otherwise authorized. Use wheel cutters where practicable. On steel pipe 6 inches and larger, an approved gas cutting and beveling machine may be used. Cut thermoplastic and fiberglass pipe in accordance with AGA XR0603.

A. Metallic Piping Installation

Bury underground piping a minimum of 18 inches below grade. Make changes in direction of piping with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction is not permitted. Branch connection may be made with either tees or forged branch outlet fittings. Provide branch outlet fittings which are forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Do not use aluminum alloy pipe in exterior locations or underground.

B. Metallic Tubing Installation

Install metallic tubing using gas tubing fittings approved by the tubing manufacturer. CSST gas piping systems must be installed by contractors who have completed the manufacturer's training program as indicated on a certification card. Make branch connections with tees. Prepare all tubing ends with tools designed for that purpose. Do not use aluminum alloy tubing in exterior locations or underground. Maintain electrical continuity of gas piping system in accordance with NFPA 54, paragraph entitled 'Electrical Bonding and Grounding'.

- C. Connections Between Metallic and Plastic Piping Connections between metallic and plastic piping are only allowed outside, underground, and with approved transition fittings.
- D. Piping and Tubing Buried Under Buildings

Run underground piping and tubing installed beneath buildings in a steel pipe casing protected from corrosion with protective coatings or installed within a watertight plastic conduit or as part of a listed encasement system. Extend casing or encasement system at least 4 inches outside the building and provide the pipe with spacers and end bushings to seal at both ends to prevent the entrance of water and/or the escape of gas. Extend a vent line from the annular space above grade outside to a point where gas will not be a hazard and terminate in a rain/insect-resistant fitting.

E. Concealed Piping in Buildings

Do not use combinations of fittings (unions, tubing fittings, running threads, right- and lefthand couplings, bushings, and swing joints) to conceal piping within buildings.

1. Piping and Tubing in Partitions

Locate concealed piping and tubing in hollow, rather than solid, partitions. Protect tubing passing through walls or partitions against physical damage both during and after construction and provide appropriate safety markings and labels. Provide protection of concealed pipe and tubing in accordance with ANSI LC 1/CSA 6.26.

2. Piping in Floors

Lay piping in solid floors except where embedment in concrete is indicated in channels suitably covered to permit access to the piping with minimum damage to the building. Surround piping embedded in concrete by a minimum of 1-1/2 inches of concrete and do not allow physical contact with other metallic items such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quickset additives or cinder aggregate.

F. Aboveground Piping

Run aboveground piping as straight as practicable along the alignment and elevation indicated, with a minimum of joints, and separately supported from other piping system and equipment. Install exposed horizontal piping no farther than 6 inches from nearest parallel wall and at an elevation which prevents standing, sitting, or placement of objects on the piping.

G. Final Gas Connections

Unless otherwise specified, make final connections with rigid metallic pipe and fittings. Make final connections to kitchen ranges using flexible connectors not less than 40 inch long, to afford access to coupling and to permit movement of equipment for cleaning. Flexible connectors may be used for final connections to residential dryers. Flexible connectors may be used for final connections to gas utilization equipment. In addition to cautions listed in instructions required by ANSI standards for flexible connectors, insure that flexible connector do not pass-through equipment cabinet. Provide accessible gas shutoff valve and coupling for each gas equipment item.

3.6 PIPE JOINTS

Design and install pipe joints to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

A. Threaded Metallic Joints

Provide threaded joints in metallic pipe with tapered threads evenly cut and made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, ream pipe and remove all burrs. Caulking of threaded joints to stop or prevent leaks is not permitted.

B. Welded Metallic Joints

Conform beveling, alignment, heat treatment, and inspection of welds to NFPA 54. Remove weld defects and make repairs to the weld, or remove the weld joints entirely and reweld. After filler metal has been removed from its original package, protect and store so that its characteristics or welding properties are not affected adversely. Do not use electrodes that have been wetted or have lost any of their coating.

- C. Thermoplastic and Fiberglass Joints
 - Thermoplastic and Fiberglass Conform jointing procedures to AGA XR0603. Do not make joints with solvent cement or heat of fusion between different kinds of plastics.
 - 2. PE Fusion Welding Inspection Visually inspect butt joints by comparing with, manufacturer's visual joint appearance chart. Inspect fusion joints for proper fused connection. Replace defective joints by cutting out defective joints or replacing fittings. Inspect, in conformance with API 570, 100 percent of all joints and re-inspect all corrections. Arrange with the pipe manufacturer's representative in the presence of the Contracting Officer to make first time inspection.
- D. Flared Metallic Tubing Joints

Make flared joints in metallic tubing with special tools recommended by the tubing manufacturer. Use flared joints only in systems constructed from nonferrous pipe and tubing, when experience or tests have demonstrated that the joint is suitable for the conditions, and when adequate provisions are made in the design to prevent separation of the joints. Do not use metallic ball sleeve compression-type tubing fittings for tubing joints.

- E. Solder or Brazed Joints Make all joints in metallic tubing and fittings with materials and procedures recommended by the tubing supplier. Braze joints with material having a melting point above 1000 degrees F, containing no phosphorous.
- F. Joining Thermoplastic or Fiberglass to Metallic Piping or Tubing When compression type mechanical joints are used, provide gasket material in the fittings compatible with the plastic piping and with the gas in the system. Use an internal tubular rigid

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stiffener in conjunction with the fitting, flush with end of the pipe or tubing, extending at least to the outside end of the compression fitting when installed. Remove all rough or sharp edges from stiffener. Do not force fit stiffener in the

plastic. Split tubular stiffeners are not allowed.

G. Press Connections

Make press connections in accordance with manufacturer's installation instructions using tools approved by the manufacturer. Fully insert the tubing into the fitting and then mark at the shoulder of the fitting. Check the fitting alignment against the mark on the tubing to assure the tubing is fully inserted before the joint is pressed.

3.7 PIPE SLEEVES

Provide pipes passing through concrete or masonry walls or concrete floors or roofs with pipe sleeves fitted into place at the time of construction. Do not install sleeves in structural members except where indicated or approved. Make all rectangular and square openings as detailed. Extend each sleeve through its respective wall, floor or roof, and cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Extend sleeves in mechanical room floors above grade at least 4 inches above finish floor. Unless otherwise indicated, use sleeves large enough to provide a minimum clearance of 1/4 inch all around the pipe. Provide steel pipe for sleeves in bearing walls, waterproofing membrane floors, and wet areas. Provide sleeves in nonbearing walls, floors, or ceilings of steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, seal the annular space between the pipe and sleeve with fire-stopping material and sealant that meet the requirement of Section 07 84 00 FIRESTOPPING.

3.8 PIPES PENETRATING WATERPROOFING MEMBRANES

Install pipes penetrating waterproofing membranes as specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.9 FIRE SEAL

Fire seal all penetrations of fire rated partitions, walls and floors in accordance with Section 07 84 00 FIRESTOPPING.

3.10 ESCUTCHEONS

Provide escutcheons for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.11 SPECIAL REQUIREMENTS

Provide drips, grading of the lines, freeze protection, and branch outlet locations as shown and conforming to the requirements of NFPA 54NFPA 58.

3.12 BUILDING STRUCTURE

Do not weaken any building structure by the installation of any gas piping. Do not cut or notch beams, joists or columns. Attach piping supports to metal decking. Do not attach supports to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer.

3.13 PIPING SYSTEM SUPPORTS

Support gas piping systems in buildings with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Do not support any gas piping system by other piping. Conform spacing of supports in gas piping and tubing installations to the requirements of NFPA 54NFPA 58. Conform the selection and application of supports in gas piping and tubing installations to the requirements of MSS SP-58. In the support of multiple pipe runs on a common base member, use a clip or clamp where each pipe crosses the base support member. Spacing of

the base support members is not to exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. Rigidly connect the clips or clamps to the common base member. Provide a clearance of 1/8 inch between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.14 ELECTRICAL BONDING AND GROUNDING

Provide a gas piping system within the building that is electrically continuous and bonded to a grounding electrode as required by NFPA 54, NFPA 58, and NFPA 70.

3.15 SHUTOFF VALVE

Install the main gas shutoff valve controlling the gas piping system to be easily accessible for operation, as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled. Install valves approximately at locations indicated. Orient stems vertically, with operators on top, or horizontally. Provide PE piping manufacturer bracket support assembly securely fastened to structure for valve connections to resist operating torque applied to PE pipes. Provide stop valve on service branch at connection to main and shut-off valve on riser outside of building.

3.16 LINE AND APPLIANCE PRESSURE REGULATORS

Install line pressure regulators and appliance regulators in accordance with the manufacturer's requirements and in accordance with NFPA 54. Install each regulator in an accessible location and install shutoff valves ahead of each line and appliance regulator to allow for maintenance. Where vent limiting devices are not included in the regulators, install a vent pipe to the exterior of the building. Terminate all service regulator vents and relief vents in the outside air in rain and insect resistant fittings. Locate the open end of the vent where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

3.18 CATHODIC PROTECTION

Provide cathodic protection for underground ferrous gas piping as specified.

3.19 TESTING

Submit test procedures and reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Test entire gas piping system to ensure that it is gastight prior to putting into service. Prior to testing, purge the system, clean, and clear all foreign material. Test each joint with an approved gas detector, soap and water, or an equivalent nonflammable solution. Inspect and test each valve in conformance with API Std 598 and API Std 607. Complete testing before any work is covered, enclosed, or concealed, and perform with due regard for the safety of employees and the public during the test. Install bulkheads, anchorage and bracing suitably designed to resist test pressures if necessary, and as directed and or approved by the Contracting Officer. Do not use oxygen as a testing medium.

A. Pressure Tests

Submit test procedures and reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Before appliances are connected, test by filling the piping systems with air or an inert gas to withstand a minimum pressure of 3 pounds gauge for a period of not less than 10 minutes as specified in NFPA 54 as specified in NFPA 58 without showing any drop in pressure. Do not use Oxygen for test. Measure pressure with a mercury manometer, slope gauge, or an equivalent device calibrated to be read in increments of not greater than 0.1 pound. Isolate the source of pressure before the pressure tests are made.

B. Pressure Tests for Liquified Petroleum Gas Pressure test system as described above. When appliances are connected to the piping

system, use fuel gas for testing appliances to withstand a pressure of not less than 10.0 inches nor more than 14.0 inches water column (0.36 nor more than 0.51 pounds per square inch) for a period of not less than 10 minutes without showing any drop in pressure. Measure pressure with a water manometer or an equivalent device calibrated to be read in increments of not greater than 0.1 inch water column. Isolate the source of pressure before the pressure tests are made.

C. Test With Gas

Before turning on gas under pressure into any piping, close all openings from which gas can escape. Immediately after turning on the gas, check the piping system for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. Conform all testing to the requirements of NFPA 54NFPA 58. If leakage is recorded, shut off the gas supply, repair the leak, and repeat the tests until all leaks have been stopped.

D. Purging

After testing is completed, and before connecting any appliances, fully purge all gas piping. LPG piping tested using fuel gas with appliances connected does not require purging. Conform testing procedures to API RP 1110. Do not purge piping into the combustion chamber of an appliance. Do not purge the open end of piping systems into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

E. Labor, Materials and Equipment Furnish all labor, materials and equipment necessary for conducting the testing and purging.

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SECTION 23 31 13 METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Single-wall rectangular ducts and fittings.
- 2. Single-wall round ducts and fittings.
- 3. Sheet metal materials.
- 4. Sealants and gaskets.
- 5. Hangers and supports.
- B. Related Sections:
 - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.

1.3 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 2005 "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article. References given in this specification are from SMACNA's 2005 edition.
- B. Structural Performance: Duct hangers and supports shall with stand the effects of gravityloads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

- 1. Liners and adhesives.
- 2. Sealants and gaskets.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation details, including components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Reinforcement and spacing.
 - 4. Seam and joint construction.
 - 5. Penetrations through fire-rated and other partitions.
 - 6. Equipment installation based on equipment being used on Project.
 - 7. Duct accessories, including dampers, turning vanes, and access doors and panels.
 - 8. Hangers and supports, including methods for duct and building attachmentand vibration isolation.
- C. Delegated-Design Submittal:
 - 1. Sheet metal thicknesses.
 - 2. Duct transverse joints.
 - 3. Duct connection systems.
 - 4. Joint and seam construction and sealing.
 - 5. Reinforcement details and spacing.
 - 6. Materials, fabrication, assembly, and spacing of hangers and supports.

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- D. 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. Penetrations of smoke barriers and fire-rated construction.
 - 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.
- E. Welding certificates.
- F. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code Steel," for hangers and supports.
 - 2. AWS D1.2, "Structural Welding Code Aluminum," for aluminum supports.
 - 3. AWS D9.1M "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 -"HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's 2005 Edition "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class.
 - 1. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of non-braced panel unless ducts are lined.
 - 2. Unless otherwise indicated, the net free area of the duct dimensions given on the Drawings shall be maintained. The duct dimensions shall be increased as necessary to compensate for the liner thickness.
 - 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.
 - 1. Prefabricated Slide-on Joints and Components:
 - a. Manufacturers:
 - 1) Ductmate Industries, Inc.
 - 2) Ward Industries, Inc.
 - b. Apply joints using manufacturer's "Duct Construction Standards" for material thickness, reinforcement size and spacing, and joint reinforcement
 - c. Slide-on joints must include the use of corners, bolts, cleats, and gaskets.
 - d. Prefabricated slide-on joints shall be used on duct sizes larger than allowed for formed-on flanges. Refer to the following paragraph.
 - 2. Formed-on Flanges and Components:

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- Construct according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible." Formed-on flanges shall be constructed as T-25A (T.D.C.) and T-25B (T.D.F.) joints.
- b. Formed-on flanges must include the use of corners, bolts, cleats, and gaskets.
- c. Maximum Duct Size:
 - 1) Up to 60-inches wide for 2-inch pressure class (for 5 ft. joints).
 - 2) Up to 42-inches wide for 4-inch pressure class (for 5 ft. joints).
- 3. Slips and Drives (Traditional):
 - a. Construct according to 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.
- 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.
 - 1. Elbows: Fabricate fittings with a centerline radius equal to 1.5 times the associated duct widths up to 28 inches wide, and 1.0 times the duct width for duct widths 30 inches wide and wider. Figure 4-2; Type RE-1 radius elbow and Type RE-5 dual radius elbow.
 - a. Where elbows with a shorter radius are necessary, fabricate elbows with a 4-inch minimum throat radius, full radius heel, and with two vanes. Figure 4-2; Type RE-3.
 - b. Where square throat elbows are indicated, fabricate elbows with turning vanes. Figure 4-2; Type RE-2. Use vanes and vane runners according to Figure 4-3.
 - 2. Divided Flow Fittings: Fabricate fittings as described for elbows. Figure 4-5; Types 4A and 4B.
 - a. Limit the use take-off branch fittings as indicated or where the area of the branch is 25 percent or less of the main duct area. Figure 4-5; Type 3.
 - 3. Branch Connections: Fabricate rectangular branches with 45-degree entry using clinchlock joints. Figure 4-6.
 - 4. Transitions: Limit concentric transitions to 45-degrees for diverging, and 60-degrees for converging; limit single-sided transitions to 30-degrees. Figure 4-7.
 - a. Transitions include changes in duct areas or profiles including square-to-round fittings.
 - 5. Offsets: Limit angled offsets to a maximum of 45-degrees. Use mitered offsets, Figure 4-7; Type 2.
 - a. Fabricate offsets with radius throats and heels wherever possible. Figure 4-7; Type 3.

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with the latest edition of SMACNA's 2005 Edition "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. Semco, Inc.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to the latest edition of SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-1, "Round Duct Transverse

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Joints," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions.

- 1. Ducts Up to 16-inch Diameter:
 - a. Interior, center-beaded sleeve joint. Figure 3-1; Type RT-1.
 - b. Beaded crimp joints may be used for longitudinal seam ducts. Figure 3-1; Type RT-5.
 - c. Prefabricated three-piece, gasketed, flanged joint consisting of two inner ring flanges with sealant and one external closure band with gasket. Similar to Ductmate "Spiralmate."
- 2. Ducts 17 to 60-inch Diameter:
 - a. Interior, center-beaded sleeve joint. Figure 3-1; Type RT-1.
 - b. Prefabricated three-piece, gasketed, flanged joint consisting of two inner ring flanges with sealant and one external closure band with gasket. Similar to Ductmate "Spiralmate."
- 3. Ducts Larger than 60-inch Diameter:
 - a. Companion angle flanged joints with gasket, sealed before and after fastening. Figure 3-1; Type RT-2.
 - b. Prefabricated self-sealing gasketed flanged joint. Similar to "AccuFlange," or "Spiralmate Flange."
- C. 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.
 - 1. Fabricate round ducts with grooved seam. Figure 3-1; Type RL-5.
 - 2. Fabricate round ducts with spiral lock seam. Figure 3-2; Type RL-1.
 - 3. Snaplock seams, Figure 3-2; Types RL-6A, R:L-6B, RL-7, RL-8 may be used for duct sizes 16-Inch Diameter and Smaller for 2-inch static pressure class ducts.
 - 4. Fabricate round ducts Larger than 60 inches in diameter with continuous butt-welded or continuous lap and seam welded longitudinal seams. Figure 3-2; Type RL-4.
- D. Elbows: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "Elbows," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions.
 - 1. Elbows: Fabricate fittings with welded seam, die-formed or segmented construction with centerline radius 1.5 times the elbow diameter.
 - a. Die-Formed Elbows (8-inches and smaller): Fabricate elbows with two-piece, dieformed, stamped or pleated construction.
 - b. Segmented Elbows (Larger than 8-inches): Fabricate elbows with welded seam construction with multiple segments or gores. Number of segments or gores as follows:
 - 1) 90 degrees 5 pieces.
 - 2) 60 degrees 4 pieces.
 - 3) 45 degrees 3 pieces.
 - 4) 30 degrees 2 pieces.
 - c. Adjustable Mitered Elbow (16-inch and Smaller): Adjustable seam, mitered elbows (4-piece 90 degree, 3-piece 45 degree) with bend radius 0.6 times the elbow diameter may be used for 2-inch duct static-pressure class. Seal joints after installation.
- E. Tees, Wyes and Laterals, Branch Connections: 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.
 - 1. Tees, Wyes and Laterals: Fabricate with welded seam construction with conical branch taps. Figure 3-6.

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- a. Fittings with riveted or bonded joints may be used for 16-inches and smaller for 2inch Duct Pressure Classification. Seal joints after installation.
- 2. Round Duct Takeoffs from Rectangular Ducts: Fabricate takeoffs with clinch-lock or spinin conical connectors with volume dampers.

2.3 SHEET METAL MATERIALS

- General Material Requirements: Comply with SMACNA's 2005 Edition "HVAC Duct Α. 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. Β.
 - Galvanized Sheet Steel: Lock-forming quality. Comply with ASTM A 653.
 - 1. Galvanized Coating Designation: G-90.
 - Finishes for Surfaces Exposed to View: Mill phosphatized "Paint-Grip." 2.
- Carbon-Steel Sheets: Comply with ASTM A 1008, with oiled, matte finish for exposed ducts. C.
- D. Stainless-Steel Sheets: Comply with ASTM A 480, Type 316; cold rolled, annealed, sheet. Concealed duct surface finish may be No.2B; exposed duct surface finish shall be No. 4.Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- Reinforcement Shapes and Plates: ASTM A 36, steel plates, shapes, and bars; use black for Ε. carbon-steel ducts and galvanized for galvanized steel ducts.
 - Use stainless steel for stainless steel duct reinforcement. 1.
 - Use aluminum for aluminum duct reinforcement. Where galvanized-steel shapes and 2. plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- Tie Rods: Galvanized steel, 3/8-inch minimum diameter. F.

SEALANT AND GASKETS 2.4

- General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and Α. 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.
- Β. Water-Based Joint and Seam Sealant:
 - Application Method: Brush on. 1.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - Water resistant. 4.
 - Mold and mildew resistant. 5.
 - VOC: Maximum 75 g/L (less water). 6.
 - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - Service: Indoor or outdoor. 8.
 - Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), 9. stainless steel, or aluminum sheets.
- Solvent-Based Joint and Seam Sealant: C.
 - 1. Application Method: Brush on.
 - 2. Base: Synthetic rubber resin.
 - Solvent: Toluene and heptane. 3.
 - Solids Content: Minimum 60 percent. 4.
 - Shore A Hardness: Minimum 60. 5.
 - 6. Water resistant.
 - 7. Mold and mildew resistant.
 - For indoor applications, sealant shall have a VOC content of 250 g/L or less when 8. calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - VOC: Maximum 395 g/L. 9.
 - Maximum Static-Pressure Class: 10-inch wg, positive or negative. 10.

SECTION 23 31 13 METAL DUCTS

- 11. Service: Indoor or outdoor.
- 12. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
 - Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.

D.

- 3. Grade: NS.
- 4. Class: 25.
- 5. Use: O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated 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.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 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 2005 Edition "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 as high as possible, unless otherwise indicated. Where overhead structure permits, route ducts between and through structural elements.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch plus allowance for insulation thickness.
- J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

SECTION 23 31 13 METAL DUCTS

- K. 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.
- L. Where ducts pass through fire-rated interior partitions and walls, install fire dampers. Where ducts pass through fire- and smoke-rated interior partitions and walls, install combination fire and smoke dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- M. Conceal ducts from view in finished spaces by locating within mechanical shafts, within hollow construction, or above suspended ceilings. Ducts shall be concealed unless otherwise indicated.
- N. Where ducts are exposed to view in finished spaces, protect exposed duct surfaces from physical damage.
- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged. Repair scratches, dents, cuts and other physical imperfections. Surfaces shall be like-new condition.
- B. Remove markings, stickers, labels, etc. from the duct surface. and markers. Prepare for field painting. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Hangers and support systems shall be likewise cleaned and prepared for finish painting
- D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's 2005 Edition "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 inchesthick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not install building attachments to metal roof decking, or other non-structural members.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch.
- 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 maximum intervals of 16 feet.

SECTION 23 31 13 METAL DUCTS

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.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's 2005 Edition "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 PAINTING

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 Division 09 painting Sections.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 TEMPORARY USE OF AIR-HANDLING SYSTEMS

- A. Refer to Division 1 Sections for additional requirements.
- B. Until the permanent air-handling systems are used, duct openings shall have closures to preclude entry of construction dirt and debris into the duct system and equipment. Extraordinary care shall be taken to keep the duct system and equipment clean.
- C. If the permanent air-handling systems are used for temporary heating or ventilating prior to completion of finishing operations, the supply systems shall be operated at 100 percent outside air (no recirculation air) with pre-filters and final filters in place and maintained.
 - 1. Operation of air-handling systems may not be possible during extreme outside air conditions due to installed equipment capacities.
 - 2. The return air system shall not be used. The duct openings on these systems shall have permanent closures.
- D. When the building is substantially complete, the permanent air-handling system may be utilized with return air and with air filters in place. Extra-ordinary care shall be taken to prevent dirt and /or moisture from entering the duct systems.
 - 1. Filters: Maintain clean air filters in place. Install permanent air filters prior to Owner occupancy of the Project.
 - 2. Equipment: Maintain fans and equipment until Owner occupancy of the Project.
- E. Air-handling systems shall be vacuum cleaned, and equipment surfaces washed as may be necessary to restore the duct systems and equipment to like-new condition prior to final acceptance by the Owner.
- 3.8 START UP
 - A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

SECTION 23 31 13 METAL DUCTS

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.
- B. Supply-Air and Return-Air Ducts:
 - 1. Ducts Connected to Constant-Air Volume Air-Handling Units Smaller than 10,000 CFM:
 - a. Pressure Class: Positive 2-inch wg; negative 2-inch wg.
 - b. SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round: 6.
- C. Outside Air Ducts:
 - a. Pressure Class: Positive 2-inch wg; negative 2-inch wg.
 - b. SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round: 6.
- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round: 6.

END OF SECTION 23 31 13

SECTION 23 31 13 METAL DUCTS

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SECTION 23 33 00 AIR DUCT ACCESSORIES

PART 1 - GENERAL

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

SUMMARY 1.2

- A. Section Includes:
 - Manual volume dampers. 1
 - 2. Fire dampers.
 - 3. Flange connectors.
 - Turning vanes. 4.
 - Duct-mounted access doors. 5.
 - 6. Elexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.
- Β. **Related Requirements:**
 - Division 28 Section "Digital, Addressable Fire-Alarm System" for duct-mounted fire and 1. smoke detectors.

ACTION SUBMITTALS 1.3

- Product Data: For each type of product. Α.
- Shop Drawings: For duct accessories. Include plans, elevations, sections, details and Β. attachments to other work.
 - Detail duct accessories fabrication and installation in ducts and other construction. 1. 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.
 - Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and c. corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - d. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted A. 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.
- Source quality-control reports. В.

1.5 CLOSEOUT SUBMITTALS

Operation and Maintenance Data: For air duct accessories to include in operation and Α. maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- Furnish extra materials that match products installed and that are packaged with protective Α. covering for storage and identified with labels describing contents.
 - Fusible Links: Furnish quantity equal to 10 percent of amount installed. 1.

SECTION 23 33 00 AIR DUCT ACCESSORIES

PART 2 - PRODUCTS

2.1 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.

2.2 MATERIALS

Α.

- Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
- 1. Galvanized Coating Designation: G60 (Z180) G90 (Z275).
- 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. Nailor Industries Inc.
 - f. Pottorff.
 - g. Ruskin Company.
 - h. Trox USA Inc.
 - i. Vent Products Company, Inc.
 - 2. Standard leakage rating.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

SECTION 23 33 00 AIR DUCT ACCESSORIES

- 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
 - 1. Size: 0.5-inch (13-mm) diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zincplated steel, and a 3/4-inch (19-mm) hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.
- 2.4 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. Cesco Products; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Metalaire, Inc.
 - 5. Nailor Industries Inc.
 - 6. Pottorff; a division of PCI Industries, Inc.
 - 7. Prefco; Perfect Air Control, Inc.
 - 8. Ruskin Company.
 - B. Description: Fire Dampers.
 - 1. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
 - 2. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
 - 3. Fire Rating: 1-1/2 hours, and 3 hours where indicated.
 - 4. Frame: Curtain type with blades outside airstream, except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick (22 gauge) galvanized steel; with mitered and interlocking corners.
 - 5. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - a. Minimum Thickness: 0.040-inch thick (20 gauge), and of length to suit application.
 - b. 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.
 - 6. Mounting Orientation: Vertical or horizontal as indicated.
 - 7. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
 - 8. Closure Springs (if required): Stainless-steel, constant force type.
 - 9. Heat-Responsive Device: Replaceable, 165 deg F rated fusible links.
 - 10. Equivalent to Ruskin DIBD2, Style B.

2.5 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
 - C. Material: Galvanized steel.
 - D. Gage and Shape: Match connecting ductwork.

SECTION 23 33 00 AIR DUCT ACCESSORIES

2.6 TURNING VANES

- 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. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. SEMCO Incorporated.
 - 4. Sheet Metal Connectors, Inc.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's 1995 "HVAC Duct Construction Standards -Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 36 inches wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

- 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. Cesco Products; a division of Mestek, Inc.
 - 2. Ductmate Industries, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Pottorff; a division of PCI Industries, Inc.
 - 6. Ventfabrics, Inc.
- B. Duct-Mounted Access Doors: Fabricate access doors according to SMACNA's 1995 "HVAC Duct Construction Standards Metal and Flexible"; Figure 2-10, "Duct Access Doors and Panels," or provide equivalent manufactured access doors.
 - 1. Door:

2.

- a. Double wall, rectangular.
- b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
- c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
- d. Fabricate doors airtight and suitable for duct pressure class.
- Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- 3. Number of Hinges and Locks:
 - a. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - b. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside handles.

2.8 FLEXIBLE CONNECTORS

- 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. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - B. Materials: Flame-retardant or noncombustible fabrics.
 - C. Coatings and Adhesives: Comply with UL 181, Class 1.
 - D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel. Provide metal compatible with connected ducts.
 - E. 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.

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- 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd.
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. 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.
- 2.9 FLEXIBLE DUCTS
 - 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. Flexmaster U.S.A., Inc.
 - 2. Thermaflex.
 - B. Noninsulated, Flexible Duct: UL 181, Class 1 air duct, PVC-coated fiberglass cloth fabric supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative up to 16-inch diameter.
 - 2. Maximum Air Velocity: 6000 fpm.
 - 3. Temperature Range: Minus 20 to plus 250 deg F.
 - 4. Thermaflex S-TL. Flexmaster NI-45.
 - C. Insulated, Flexible Duct: UL 181, Class 1 air duct, PVC-coated fiberglass cloth fabric or chlorinated polyethylene liner supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 2.0-inch wg negative.
 - 2. Maximum Air Velocity: 6000 fpm.
 - 3. Temperature Range: Minus 20 to plus 250 deg F.
 - 4. Insulation R-value: R 4.2 per ASTM C-518.
 - 5. Thermaflex M-KC or M-KE. Flexmaster Type 4M or 9M.
 - D. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, or nylon strap in sizes 3 through 18 inches, to suit duct size.

2.10 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.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
 - 2. Adhesives shall comply with the testing and product requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of

SECTION 23 33 00 AIR DUCT ACCESSORIES

Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", Version 1.1.

PART 3 - EXECUTION

3.1 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 fire dampers according to UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Downstream from manual volume dampers and equipment.
 - Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 3. At each change in direction and at maximum 50-foot (15-m) spacing.
 - 4. Upstream from turning vanes.
 - 5. Control devices requiring inspection.
 - 6. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
 - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
 - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
 - 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
 - 5. Body Access: 25 by 14 inches (635 by 355 mm).
 - 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.
- L. Connect diffusers or light troffer boots to ducts directly.
- M. Install duct test holes where required for testing and balancing purposes.
- N. 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 (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.

SECTION 23 33 00 AIR DUCT ACCESSORIES

- 2. Inspect locations of access doors and verify that purpose of access door can be performed.
- 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
- 4. Inspect turning vanes for proper and secure installation.
- 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 33 00 AIR DUCT ACCESSORIES

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SECTION 23 34 16 CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Ceiling-mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: 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. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.
- 1.7 QUALITY ASSURANCE
 - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. 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.

SECTION 23 34 16 CENTRIFUGAL HVAC FANS

1.8 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Coolair Corporation.
 - 2. Ammerman; Millennium Equipment.
 - 3. Breidert Air Products.
 - 4. Broan-NuTone LLC.
 - 5. Broan-NuTone LLC; NuTone Inc.
 - 6. Carnes Company.
 - 7. FloAire.
 - 8. Greenheck Fan Corporation.
 - 9. JencoFan.
 - 10. Loren Cook Company.
 - 11. PennBarry.
 - 12. W.W. Grainger, Inc.; Dayton Products.
 - Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:

В.

- 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
- 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
- 3. Isolation: Rubber-in-shear vibration isolators.
- 4. Manufacturer's standard roof jack or wall cap, and transition fittings.
- G. Capacities and Characteristics: See schedule on drawings.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

SECTION 23 34 16 CENTRIFUGAL HVAC FANS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support units using spring isolators having a static deflection of 1 inch (25 mm)
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 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, align and adjust belts, and install belt guards.
 - 5. Adjust damper linkages for proper damper operation.
 - 6. Verify lubrication for bearings and other moving parts.
 - 7. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

END OF SECTION 23 34 16

SECTION 23 34 16 CENTRIFUGAL HVAC FANS

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SECTION 23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes ceiling, floor and wall-mounted diffusers, registers, and grilles.

1.3 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.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- 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. Krueger Manufacturing Co.
 - 2. Price Industries.
 - 3. Titus.
- B. General: Refer to Drawings and Schedules. Provide air diffusers of the type, size, shape and capacity; and constructed of materials and with the components and accessories indicated.
- C. Performance: Provide air diffusers with performance characteristics equal to the scheduled products. Performance shall include minimum and maximum CFM, static pressure drop, velocity profiles, air throw and drop, and sound performance. Performance shall be compared with the performance of the scheduled product as described in the current manufacturer's product data.
- D. Mounting Compatibility: Provide air diffusers with frame and border styles that are compatible with the surface on which they are installed. Refer to Architectural Drawings and Specifications for ceiling types and applications.
 - 1. Lay-in Ceilings: Provide air diffusers specifically manufactured for the ceiling type indicated with accurate fit and adequate support.
 - 2. Surface-Mounted: Provide air diffusers with a flush perimeter frame and gasket to seal tight against the mounting surface. Provide accurate fit and adequate support.
 - 3. Attachments: Attach to surfaces without the use of visible fasteners.
 - 4. Linear Diffusers: Provide means to join diffuser sections with hairline butt joints without the use of visible fasteners. Provide end terminations on diffusers. Provide blank-off panels as indicated.
- E. Adjustable Air Pattern: Provide air diffusers with field adjustable air pattern devices, capable of changing the air pattern from full horizontal to full vertical down air flow, and for directional air flows as indicated on the Drawings.
- F. Adjustable Air Volume: Provide air diffusers with field adjustable air volume devices, accessible from the face of the diffuser. The air volume device may be omitted where a diffuser is the only outlet downstream of an accessible duct air damper.
- G. Materials and Finishes: Provide air diffusers with the materials and finishes scheduled.
- H. Air Plenums: Provide diffuser air plenums as indicated on the Drawings. Refer to "Air Plenums" Article in this Section.

SECTION 23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

2.2 REGISTERS AND GRILLES

- 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. Krueger Manufacturing Co.
 - 2. Price Industries.
 - 3. Titus.
 - 4. Nailor.
 - 5. Tuttle and Bailey
- B. General: Refer to Drawings and Schedules. Provide air registers and grilles of the type, size, shape and capacity; and constructed of materials and with the components and accessories indicated.
- C. Performance: Provide registers and grilles with performance characteristics equal to the scheduled products. Performance shall include minimum and maximum CFM, static pressure drop velocity profiles, air throw and drop, and sound performance. Performance shall be compared with the performance of the scheduled product as described in the current manufacturer's product data.
- D. Mounting Compatibility: Provide registers and grilles with frame and border styles that are compatible with the surface on which they are installed. Refer to Architectural Drawings and Specifications for ceiling types and applications.
 - 1. Lay-in Ceilings: Provide registers and grilles that are compatible with the ceiling type indicated with accurate fit and adequate support.
 - 2. Surface-Mounted: Provide registers and grilles with a flush perimeter frame and gasket to seal tight against the mounting surface. Provide accurate fit and adequate support.
 - 3. Attachments: Attach to surfaces without the use of visible fasteners, if possible. Visible fasteners for registers and grilles, if used, shall be oval head screw fasteners in countersunk holes provided in the device frame. Fasteners shall be the same color and finish as the device and shall be furnished by the device manufacturer.
- E. Adjustable Air Pattern: Provide registers and grilles with field adjustable air pattern devices, capable of changing the air pattern from full horizontal to full vertical down air flow, and for directional air flows as indicated on the Drawings.
- F. Adjustable Air Volume: Provide registers and grilles with field adjustable air volume devices, accessible from the face of the register or grille. The air volume device may be omitted where the register is the only outlet downstream of an accessible duct air damper.
- G. Air Plenums: Provide register and grille air plenums as indicated on the Drawings. Refer to "Air Plenums" Article in this Section.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb. Install diffusers, registers, and grilles in perfect alignment with ceiling lines.
- 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

SECTION 23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

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SECTION 23 54 00 FURNACES

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. Gas-fired, condensing furnaces and accessories complete with controls.
 - 2. Air filters.
 - 3. Refrigeration components.

1.3 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:
 - 1. Furnace.
 - 2. Thermostat.
 - 3. Air filter.
 - 4. Refrigeration components.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals for each of the following:
 - 1. Furnace and accessories complete with controls.
 - 2. Air filter.
 - 3. Refrigeration components.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Disposable Air Filters: Furnish two complete sets.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

SECTION 23 54 00 FURNACES

- 1.9 WARRANTY
 - A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
 - 1. Warranty Period, Commencing on Date of Substantial Completion:
 - a. Furnace Heat Exchanger: 10 years.
 - b. Integrated Ignition and Blower Control Circuit Board: Five years.
 - c. Draft-Inducer Motor: Five years.
 - d. Refrigeration Compressors: 10 years.
 - e. Evaporator and Condenser Coils: Five years.

PART 2 - PRODUCTS

2.1 GAS-FIRED FURNACES, CONDENSING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Adams Manufacturing Company.
 - 2. Amana Heating & Air Conditioning; Goodman Manufacturing Company, L.P.
 - 3. American Standard Companies, Inc.
 - 4. Arcoaire Air Conditioning & Heating; a division of International Comfort Products, LLC.
 - 5. Armstrong Air Conditioning Inc.
 - 6. Bryant Heating & Cooling Systems; Div. of United Technologies Corp.
 - 7. Carrier Corporation; Div. of United Technologies Corp.
 - 8. Clare Brothers.
 - 9. Comfort-Aire; a division of Heat Controller, Inc.
 - 10. Comfortmaker Air Conditioning & Heating; a division of International Comfort Products, LLC.
 - 11. Dornback Furnace.
 - 12. Goodman Manufacturing Company, L.P.
 - 13. Heil Heating & Cooling Products; a division of International Comfort Products, LLC.
 - 14. Lennox Industries Inc.
 - 15. Luxaire Corporation; a division of Unitary Products Group.
 - 16. Rheem Manufacturing Company; Air Conditioning Division.
 - 17. Ruud Air Conditioning Division.
 - 18. Tempstar Heating & Cooling Products; a division of International Comfort Products, LLC.
 - 19. Thermo Products, Inc.; a division of Burnham Holdings Inc.
 - 20. Trane.
 - 21. York International Corp.; a division of Unitary Products Group.
- B. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
- C. Cabinet: Galvanized steel.
 - 1. Cabinet interior around heat exchanger shall be factory-installed insulation.
 - 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 - 3. Factory paint external cabinets in manufacturer's standard color.
 - 4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
 - 1. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 2. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Division 23 Section "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.

D.
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SECTION 23 54 00 FURNACES

- 3. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
- E. Type of Gas: Natural.
- F. Heat Exchanger:
 - 1. Primary: Stainless steel.
 - 2. Secondary: AL29-4C steel.
- G. Burner:
 - 1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 - 2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- H. Gas-Burner Safety Controls:
 - 1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 - 2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 - 3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- I. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings pre-purges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- J. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.

K. Accessories:

- 1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof.
- 2. Polypropylene Vent Materials.
 - a. Polypropylene Pipe: complying with UL-1738 and ASTM E-814.
 - b. Polypropylene Fittings: complying with UL-1738, factory installed gasketed type with metal support clips.
- 3. PVC Plastic Vent Materials:
 - a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
 - b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
 - c. PVC Solvent Cement: ASTM D 2564.
 - 1) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3) Solvent cement and adhesive primer 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."
- L. Capacities and Characteristics:
 - 1. See Mechanical Schedules on Plan Sheets.

2.2 THERMOSTATS

- A. Solid-State Thermostat: Wall-mounted, programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.
- B. Control Wiring: Unshielded twisted-pair cabling.
 - 1. No. 24 AWG, 100 ohm, four pair.
 - 2. Cable Jacket Color: Blue.

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2.3 AIR FILTERS

A. Disposable Filters: 1-inch- (25-mm-) thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher, in cardboard frame.

2.4 REFRIGERATION COMPONENTS

- A. General Refrigeration Component Requirements:
 - 1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFCfree refrigerants.
 - 2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
- B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet complying with ASHRAE 62.1.
 - 1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.
- C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.
 - 1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1 inch (25 mm) thick.
- D. Air-Cooled, Compressor-Condenser Unit:
 - 1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - 2. Compressor: Hermetically sealed reciprocating or scroll type.
 - a. Crankcase heater.
 - b. Vibration isolation mounts for compressor.
 - c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - e. Refrigerant: R-407C or R-410A.
 - 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
 - 4. Fan: Aluminum-propeller type, directly connected to motor.
 - 5. Motor: Permanently lubricated, with integral thermal-overload protection.
 - 6. Mounting Base: Polyethylene.
- E. Capacities and Characteristics:
 - 1. See Mechanical Schedules on Plan Sheets.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

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SECTION 23 54 00 FURNACES

3.2 INSTALLATION

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
- C. Controls: Install thermostats and humidistats at mounting height of 48 inches (1500 mm) above floor.
- D. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- E. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- F. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

3.3 CONNECTIONS

- A. Gas piping installation requirements are specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - c. Requirements for Low-Emitting Materials:
 - 1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4) Solvent cement and adhesive primer 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. Slope pipe vent back to furnace or to outside terminal.
- D. Connect ducts to furnace with flexible connector. Comply with requirements in Division 23 Section "Air Duct Accessories."
- E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressorcondenser unit.
 - 1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."

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SECTION 23 54 00 FURNACES

- 2. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- 3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical test and visual and mechanical inspection.
 - 2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 - 4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.5 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Inspect for physical damage to unit casings.
 - 2. Verify that access doors move freely and are weathertight.
 - 3. Clean units and inspect for construction debris.
 - 4. Verify that all bolts and screws are tight.
 - 5. Adjust vibration isolation and flexible connections.
 - 6. Verify that controls are connected and operational.
- B. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.
- C. Measure and record airflows.
- D. Verify proper operation of capacity control device.
- E. After startup and performance test, lubricate bearings.

3.6 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.7 CLEANING

- A. After completing installation, clean furnaces internally according to manufacturer's written instructions.
- B. Install new filters in each furnace within 14 days after Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 54 00

SECTION 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

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.
- B. Divisions 26, 27, and 28 apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
- 1.3 DEFINITIONS
 - A. Basic Contract definitions are as follows:
 - 1. Provide: The term "provide" means "to furnish and install, ready for the intended use and in complete operating condition."
 - 2. Furnish: The term "furnish" means "to purchase devices and/or equipment and hand over to another entity for installation"
 - 3. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
 - 4. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.
 - 5. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contracts.
 - 6. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
 - 7. Contractor: The term "Contractor" shall carry the same meaning as "Electrical Contractor" or "Division 26 Contractor".
 - 8. Or Equal: The term "Or equal" shall carry the same meaning as "approved as equal by the Engineer"
 - 9. Owner: All references here-in and on drawings to "Owner" shall be the same as South Dakota Department of Military.
 - B. Product specific to this section definitions:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.
- 1.4 COORDINATION
 - A. All drawings, specifications and documents for this project shall be taken as a whole. Prior to installation, the Contractor shall be familiar with this project by carefully reviewing and comparing all documents that pertain to this project.
 - B. In preparation of the contract documents, a reasonable effort has been made to provide layouts and connections based on selected and specified manufacturer's equipment. Since physical space, electrical connections, equipment arrangements and other requirements may vary

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according to each manufacturer, the final responsibility for connections, initial access and proper fit is the responsibility of this Contractor.

- Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations and maintain working clearances per the NEC or additional as required by these documents.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- D. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations.
- E. Coordinate installation locations of panelboards with Divisions 21, 22, and 23. The drawings diagrammatically show electrical gear, ductwork, piping, etc. The Contractors shall coordinate on site for actual installation locations. Ducts, piping, etc cannot be installed over panelboards, MCCs, or switchboards.
- F. Coordinate installation locations of all equipment with other trades to verify proper fit and function.
- G. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Provide access doors and panels as specified in Division 08 Section "Access Doors and Frames."
- H. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- I. Prior to roughing in for electrical equipment furnished by others, verify the voltage and current characteristics and control connections of this equipment. Notify the Engineer where equipment connection requirements do not match the provisions indicated on the documents.
- J. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- K. Coordinate all new utility service entrances, as well as modifications to existing services, with the appropriate serving utility company.
 - 1. Contractor shall pay all charges and fees levied by the serving utility and include these charges in the bid.
 - 2. Arrange with serving utility to obtain permanent service to the project.
 - 3. Coordinate all requirements with serving utility before bid. All utilities (power, telephone, CATV, etc.) must be maintained at all times unless approved by Owner.
 - 4. Coordinate electrical service connections to components furnished by Utility.
- L. Electrical contractor shall pay all fees for permits, licensing, and inspections applicable to the work of Division 26. Secure regular inspections as required by State and local regulations. Pay charges by regulating agencies for Drawings, Specifications, review of Drawings and Specifications, and the inspections of installations. Contractor shall pay all charges and fees levied by the serving utility and include these charges in the bid.

1.5 QUALITY ASSURANCE

- A. Drawings and Measurements
 - 1. The drawings are not intended to be scaled for roughing-in measurements or to serve as shop drawings. The Contractor shall consult the architectural, structural, mechanical, or equipment drawings for dimensions, obstructions and location of equipment of other trades.
 - 2. Outlet devices, switches, panels, cabinets, fixtures and special equipment are shown on the drawings only in a schematic manner and not necessarily in their specific location. The Contractor shall be responsible for exact locations of the outlets to form a functional and aesthetic installation either by careful review of all architectural elevations, tile

C.

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patterns, surface finishes, and equipment arrangements or by consultation with the Engineers and/or other trades involved.

- B. Ordinances and Codes
 - All work shall be executed in accordance with the current edition of the City Electrical Ordinances, State Electrical Laws and Statutes and National Electrical Code (NEC) and be subject to the inspection of these departments. All fees, permits, licenses, etc., necessary in order to complete the work of this section shall be paid by this Contractor.
- C. Workmanship
 - 1. The installation work included in this specification shall be performed in a neat workmanlike manner by persons experienced and skilled in the Electrical trade. Only the best quality workmanship will be accepted. All exposed parts of the electrical wiring systems such as exposed conduits, flush plates, cabinet trim, fixtures, etc., shall be square and true with the building construction.
- D. Guarantee
 - 1. This Contractor shall assume responsibility for any defects which may develop in any part of his work caused by faulty workmanship, material or equipment, and agrees to replace, repair, or alter, at his expense, any such faulty workmanship, material or equipment that has been brought to his attention during a period of one year from the date of substantial completion. Acceptance of the work shall not waive this guarantee.
- E. Materials and Equipment
 - 1. All materials and equipment shall be new and of best quality, of the type best suited for the purpose intended. All items shall be furnished by the Manufacturer's Authorized Supplier. All electrical materials used in this work shall be listed by the Underwriter's Laboratories, Inc., where testing is provided and shall bear their label.
 - 2. Recycle all materials per Construction Waste Management Specification 017419.
- PART 2 PRODUCTS
- 2.1 SLEEVES FOR RACEWAYS AND CABLES
 - A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 - B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 - C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 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. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Plastic. Include two for each sealing element.

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4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

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

2.4 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Low-Emitting Materials: Liquid floor treatments shall have a VOC content of 420 g/L or less
 - 3. Low-Emitting Materials: Liquid floor treatments shall comply with the testing and product requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1-2010.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.
- F. Securely fasten and support electrical components and devices.
- G. All devices installed in the ceiling grid shall be centered on the tile. Corridor devices shall be mounted in a straight line.
- H. Make electrical connections in accordance with equipment manufacturer's instructions.
- I. See all Drawings and contract documents, including Division 21, 22, and 23 for mechanical schedules, for additional installation requirements.
- J. All wiring shall be installed in conduit unless otherwise noted and of a type allowed by the contract documents. All conduits shall be concealed unless otherwise noted.
- K. In general, the electrical loads shall be circuited as shown on the Drawings. If the Division 26 contractor modifies the circuiting and can meet all the requirements of the contract documents, then it shall be allowed to be different from that shown. If changes are made, ensure that these changes are shown on the as-built drawings.
- L. Conduit routing is not shown on the Drawings. Circuit number is shown by fixtures. It is the Contractor's responsibility to provide required wire count and conduit sizing for complete and operating systems. Coordinate conduit routing on site with other disciplines. Base final installation of raceways on actual dimensions and conditions at project site.
- M. All devices/equipment in fire rated ceiling spaces and walls shall be installed in such a manner as to retain fire rating as required. All penetrations of fire rated floors or walls shall be protected

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by materials and installation details that conform to Underwriter Laboratories Listings for through penetration fire stop systems.

- N. See all Drawings and contract documents, including Division 21, 22, and 23, for approximate equipment locations and confirm locations on site. Coordinate equipment connections with Divisions 21, 22, 23, and 26 and review shop drawings and verify connection requirements (voltage, amperage, phase, location, etc). See equipment schedules for additional electrical connection requirements.
- O. Motor Phase Rotation:
 - 1. Verify proper motor rotation by "bumping" the motor. Coordinate this test with Divisions 21, 22, 23, and 26. Modify circuiting if phase rotation is not correct.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls before concrete is poured in place.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- J. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety. Remove all unused cabling not labeled for future use.

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- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site. Recycle all materials per Construction Waste Management Specification 017419.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- F. Contractor shall visit existing building before submitting bid and become familiar with existing conditions.
- G. In general, wiring in existing building shall remain as is except as noted on drawings or specified elsewhere. When existing walls, ceilings, floors, electrical panels, light fixtures, switches or other outlets are removed, Contractor shall extend existing circuiting, if required, install junction boxes in walls, ceilings or floors, if required, to continue circuiting; remove all unused wire; remove all unused conduit where accessible; and install new plates with blank gangs as required on existing outlet boxes.
- H. Contractor shall assume in his bid that all existing equipment and fixtures noted to be reused are in good working condition and can be installed without any repairs. If certain items are found to be in need of repair or in unusable condition, Contractor shall notify the A/E for decision; however, Contractor shall be responsible for any damage caused by him to equipment in removal or handling.
- I. Fixtures and other equipment removed and to be re-used shall be cleaned before reinstallation. New lamps shall be provided for all fixtures.
- J. Any existing switches or receptacles that are relocated shall be replaced with new device.
- K. Existing equipment removed and not re-used, at owner's option, shall be returned to owner. If owner does not wish to keep the items, they shall become the Contractor's property and be removed from the site, unless otherwise specified or shown.
- L. Contractor shall work closely with the Telephone Company to coordinate removal or relocation of all telephone conduit and outlets. Provide Telephone Company minimum of 48 hours notice of any demolition affecting telephone services or equipment.
- M. Demolition shown on plans is based on information shown on Owner's existing plans and an onsite review of the facility. Quantities, types, and locations of items shown are believed to be accurate. However, this contractor shall be responsible for removing and/or relocating electrical equipment as required to accommodate remodeling.
- N. In general, Contractor shall assume that all work which involves a service outage to areas occupied by the Owner or other building tenants shall be performed on an overtime basis. Work shall continue until service is restored.
- O. Coordinate all work with the Power Company for revisions to the electrical service.

3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved. Any cutting or drilling shall not affect structural integrity. Contractor shall contact A/E prior to drilling through any structural beam. No such cutting or drilling process shall endanger the structure integrity of the building.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.7 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.

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- 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
- 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 05 00

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. Low-Voltage (Power): 90 to 2000 volts.
- C. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- 1.5 COORDINATION
 - A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Southwire Company.
 - 5. Encore Wire Corporation.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN-2 and XHHW-2.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC and Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.

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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

- 3.1 CONDUCTOR MATERIAL APPLICATIONS
 - A. Services: Copper.
 - B. Feeders: Copper. Solid or stranded for No. 12 AWG; stranded for No. 10 AWG and larger.
 - C. Branch Circuits: Copper. Solid or stranded for No. 12 AWG; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN-2, or type XHHW-2 single conductors in raceway.
- B. Feeders: Type THHN-THWN-2, or type XHHW-2 single conductors in raceway.
- C. Branch Circuits: Type THHN-THWN, single conductors in raceway. Use a minimum No. 12 AWG. Metal-clad cable, Type MC, can be used.
- D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainlesssteel, wire-mesh, strain relief device at terminations to suit application.
- E. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- F. Class 2 Control Circuits: Power-limited cable, in raceway where concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway. Use Mule Tape where any friction can occur in non-metallic conduit.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. Conduit fill: A maximum of three phase conductors, each of a different phase, neutral(s), and a grounding conductor shall be installed per conduit home run.
- H. All multi-wire branch circuits shall use dedicated neutrals for each phase circuit. Do not use combined neutral conductors.
- I. GFI receptacles may feed other receptacles on the same circuit from the load side only if they are in the same room and within sight of each other.
- J. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- K. Derate conductors where conduits are exposed to sunlight on rooftops per NEC 310.15(B)(3)c.
- L. Stranded conductors shall be terminated in a proper way so all strands are effectively conductive together.
- M. Size the conductors per the overcurrent device unless otherwise noted (whether a motor, equipment connection, or other). The smallest wire size shall be #12.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

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- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack from face of box.
- D. All connections shall guarantee a good electrical and mechanical connection with conductor to conductor contact. No intermediary current path (material between conductors) is allowed. Connections shall be made using twist-on type connectors such as IDEAL INDUSTRIES connector brands WIRE-NUT®, WING NUT®, OR TWISTER®. Quick connect "stab-in" connectors will not be allowed.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.6 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including building wire, connections, and connectors.

END OF SECTION 26 05 19

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SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes methods and materials for grounding and bonding systems and equipment.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Compression Direct-Burial Grounding: System connectors of types recommended by manufacturer for materials being joined and installation conditions.
- E. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression or exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar. Non-reversible type.

2.3 GROUNDING BUSBARS

A. Predrilled rectangular bars of annealed copper, 1/4 by 4 inches by 18" (6.3 by 100 by 450 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart, or as

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indicated on drawings. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 12 AWG and smaller, and stranded conductors for No. 10 AWG and larger, unless otherwise indicated.
- B. Grounding Bus: Install intersystem bonding bar at electrical service equipment in electrical room.
 - 1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except as otherwise indicated.
 - 3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- 3.3 INSTALLATION
 - A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 - B. Where grounding or bonding conductors are routed in ferrous metallic conduit, the grounding conductor must be bonded at both ends of conduit.
 - C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors, or compression direct-burial system, for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
 - D. Bonding for Piping:
 - 1. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
 - E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
 - F. Bond across water heater piping and water softener piping.
 - G. Bond together each metallic raceway (2" and larger), pipe, duct, and other metal object at noncontact entry into equipment enclosures. Use #2 AWG bare copper conductor.
 - H. Bond bushings where reducing washers or concentric knockouts are used.

END OF SECTION 26 05 26

SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.
- 1.5 QUALITY ASSURANCE
 - A. Comply with NFPA 70.
- 1.6 COORDINATION
 - A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
 - B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.

- 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
 - A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.

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- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported. Supports shall be Listed for the installation.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or 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.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Low Voltage Cable Supports:
 - 1. Cables shall be supported by conduit, cable tray (ladder racks), or approved cable hooks.
 - 2. Cable hooks shall be installed no farther than 5' apart.
 - 3. J-hooks: Steel, UL listed, ultimate static load limit 50 lbs. minimum. Wide base, beveled edges. Provide corners, drop-outs, and direction changes with coating (Xylan) for smooth, frictionless surface. Rated to support Category 6 and higher cables, and optical fiber cables. Size and quantity shall be as required.
 - 4. If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, drop wire/rod, C and Z purlin clips.
 - 5. Provide CADDY CableCat J-hooks as manufactured by ERICO, Inc, Cooper's B-Line CAT32 Series, the Hook as manufactured by MonoSystems, or approved equivalent.
 - 6. Supply velcro straps, length and strength as required to properly organize and bundle cables. Straps shall NOT be used for supporting cables.
- G. Conduit and Cabling: All conduit and cabling shall be supported with UL Listed and Approved supports.
- H. Wire ties are not an acceptable form of raceway supports.
- I. Metal decking shall not be used to support electrical devices, light fixtures, boxes or raceway.
- J. Raceways must be a minimum of 1 1/2" from nearest surface of roof decking per NEC 300.4(E).
- K. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- B. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps, or single-bolt conduit clamps using spring friction action for retention in support channel.
- C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- D. Air-craft cable (or Gripple) with attachments to structure (not decking) and cable clips to secure raceways are allowed provided the installation meets the requirements of these specifications including, but not limited to, the minimum static design load used for strength determination shall be weight of supported components plus 200 lbs. Horizontal supports are required to be used with a minimum of supports going opposite directions every other support. Aircraft cable (or Gripple) is not allowed to support box/junction boxes.

3.2 SUPPORT INSTALLATION

- A. Raceway Support Methods: In addition to methods described in NECA 1. EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated:
 - 1. Backboards: Mount cabinets, lighting and appliance branch-circuit panelboards, disconnect switches, and control enclosures on plywood, fire-retardant treated, painted (gray), 3/4 inch. Comply with requirements for plywood backing panels specified in Division 6 Section "Rough Carpentry."
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.

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- 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
- 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
- 7. To Light Steel: Sheet metal screws.
- 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, distribution panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for sitefabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 26 Section "Identification for Electrical Systems".

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. LFNC: Liquidtight flexible nonmetallic conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. RMC: Rigid metal (steel) conduit.
- H. RTRC: Reinforced Thermosetting Resin Conduit (fiberglass conduit).
- 1.4 SUBMITTALS
 - A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
- B. RMC Rigid Steel Conduit: ANSI C80.1.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
- E. EMT: ANSI C80.3.
- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

- H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Fittings for EMT: Zinc coated steel with set-screw or compression fittings with insulated throat type.
- I. Joint Compound for Rigid Steel Conduit (RMC) or IMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 SURFACE RACEWAYS

- A. Surface Metal Raceways: For exposed raceways in finished areas where indicated or where required in existing areas where concealed conduit is not possible. Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Galvanized steel with snap-on covers. Prime coating, ready for field painting (paint to match wall).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: For exposed raceways in finished areas where indicated or where required in existing areas where concealed conduit is not possible. Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Butler Manufacturing Company; Walker Division.
 - b. Enduro Systems, Inc.; Composite Products Division.
 - c. Hubbell Incorporated; Wiring Device-Kellems Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.

2.3 BOXES AND ENCLOSURES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Garvin Industries.
 - 5. Hoffman.
 - 6. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 7. O-Z/Gedney; a unit of General Signal.
 - 8. RACO; a Hubbell Company.
 - 9. Robroy Industries, Inc.; Enclosure Division.
 - 10. Scott Fetzer Co.; Adalet Division.
 - 11. Spring City Electrical Manufacturing Company.
 - 12. Thomas & Betts Corporation.
 - 13. Walker Systems, Inc.; Wiremold Company (The).
 - 14. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

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- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- G. Low Voltage Junction Boxes:
 - 1. For 1 1/4" conduit stub up provide box similar to Hubbell RACO #259.

PART 3 - EXECUTION

Α.

3.1 RACEWAY APPLICATION

- Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit (RMC).
- 2. Concealed Conduit, Aboveground: EMT.
- 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
- 4. Enclosures, Aboveground: NEMA 250, Type 3R or 4.
- 5. Boxes: Cast aluminum. Malleable iron is prohibited.
- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit (RMC). Includes raceways in the following locations but is not limited to:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT or MC cable.
 - 5. Risers: All through floor conduit risers shall be RMC.
 - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations. Maximum of 6' in length unless otherwise approved.
 - 7. Connections to undercabinet light fixtures: 3/8" MC cable.
 - 8. Damp or Wet Locations: Rigid steel conduit (RMC).
 - 9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
 - 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size for branch circuit homeruns and all exterior work unless otherwise noted; 1/2-inch (16-mm) for other interior work unless otherwise noted.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.
- G. Communication cabling shall have long sweep elbows.
- H. All conduits 2" and larger shall have grounding bushings on ends.
- 3.2 INSTALLATION
 - A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hotwater pipes. Install horizontal raceway runs above water and steam piping.

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- B. Complete raceway installation before starting conductor installation.
- C. Protect stub-ups from damage where conduits rise through floor slabs. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- D. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- E. Sleeves: See Specifications 260500 for sleeve requirements through concrete slabs and walls.
- F. Mounting Heights: Install equipment and devices at heights indicated on Electrical Symbols & Abbreviations sheet, unless noted otherwise.
- G. Backboxes shall not be installed back-to-back. Provide 6-inch separation minimum unless otherwise noted.
- H. Do not install backboxes in fully grouted cells of masonry walls.
- I. Outlet boxes shall not be set back more than 1/4" from finished wall. Devices shall be rigidly supported to the box (not the wall) at the surface of the wall.
- J. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- K. Conduit and Cabling: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- L. Conduit shall be concealed in pre-cast panels. The electrical contractor is responsible for the installation, coordination, material, and labor of conduit, boxes, etc installed in pre-cast panels.
- M. Install no more than the equivalent of four 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- N. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- O. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- Q. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- S. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, as follows:
 - 1. Install with a maximum of three 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- T. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces (coolers and freezers).
 - 2. Where otherwise required by NFPA 70.

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

- U. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- V. All homerun conduits shall terminate directly into the top of panelboards and not have a wireway with nipple conduits between panelboard and wireway. Multiple splices (wirenuts) in a gutter above panels will not be allowed.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.4 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

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SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway.
 - 2. Identification for conductors and communication and control cable.
 - 3. Warning labels and signs.
 - 4. Instruction signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, Owner, Owner's room numbers (not plan room numbers) manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

- 2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS
 - A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
 - B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - D. Permanent Black Marker: Provide neatly handwritten label on each junction box and on the inside of each device cover plate indicating associated panel and circuit number.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, celluloseacetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
 - Available Fault Current Warning: "WARNING ARC FLASH AND SHOCK HAZARD APPROPRIATE PPE REQUIRED – AVAILABLE FAULT CURRENT: (Value calculated by Contractor) – INSTALLATION DATE: (Date)."
 - 4. Label service equipment per NEC 110.16(B).
 - 5. Label the Available Interrupting Current (AIC) on each panelboard per NEC 408.6.

2.3 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Branch-Circuit Conductor Identification: Identify all conductors in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to phase.
- B. Paint fire alarm system junction boxes and covers red.
- C. Permanent Black Marker: Provide neatly handwritten label on each junction box indicating associated panel and circuit number.
- D. Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit, where accessible, shall be identified by system per NEC 210.5(C). The means of identification shall be permanently posted on each branch-circuit distribution panelboard/equipment.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

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- 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- H. Apply warning, caution, and instruction signs as follows:
 - 1. Flash Protection: Switchboards, panelboards, and motor control center shall be field marked to warn qualified persons of potential electric arc flash hazards per NEC 110.16.
- I. Each panelboard shall be provided with a neatly typed directory with plastic protector. The Division 26 Contractor is responsible for providing the room name and/or number per the Owner's designations. The Owner's designation may not be the same as the Drawings. Division 26 is responsible for coordinating with the Owner for the designations.
- J. Instruction Signs:
 - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
 - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for fire alarm system.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Disconnect switches.
 - d. Voice and data cable terminal equipment.
 - e. Television/audio components, racks, and controls.
 - f. Fire-alarm control panel and annunciators.
 - g. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
- 3.2 INSTALLATION
 - A. Verify identity of each item before installing identification products.
 - B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
 - C. Apply identification devices to surfaces that require finish after completing finish work.

SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 240/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Neutral: White.
 - d. Ground: Green.
 - 3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 26 05 73 SHORT CIRCUIT STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

Α.

- The Contractor shall provide short circuit study.
 - 1. Short circuit and equipment duty study to verify that equipment is rated to safely handle short circuit currents without creating hazardous conditions.
- B. Electrical equipment shall be labeled based on the results of the study, as well as the available short circuit ratings and the date.
- C. Label the clearing time of service overcurrent protective devices at the service equipment.
- D. Label service equipment per 2020 NEC 110.16(B).
- E. Label all panels with AIC per 2020 NEC 408.6.
- F. Label all air conditioning and refrigeration equipment per NEC 440.10.

1.3 SUBMITTALS

- A. Product Data: For computer software program to be used for studies, including proof of compliance with IEEE 399, NFPA 70E, and IEEE 1584.
- B. <u>Provide preliminary studies and associated recommendations, prior to submitting associated</u> <u>electrical equipment shop drawings</u>. Indicate equipment AIC ratings. Provide one (1) digital copy in Adobe Acrobat (pdf) format.
- C. Final Study Submittals: The following submittals shall be made after all final field feeder sizes and lengths have been incorporated into the study and the approval process for system protective devices has been completed.
 - 1. Short Circuit Study Report

1.4 QUALITY ASSURANCE

- A. The studies shall be in conformance with the NFPA and ANSI Standards, and IEEE recommended practices detailed in this section. No substitutions in study methods or software conformance will be allowed.
- B. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- C. Short Circuit Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- D. Comply with IEEE 242 for short-circuit currents.
- E. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

- 2.1 COMPUTER SOFTWARE PROGRAM REQUIREMENTS
 - A. The system model shall be developed using a commercially available, fully integrated software package that meets the performance specifications developed in this Section. To ensure compliance with NFPA-70E (the latest version), ANSI, and IEEE Standards, and OSHA mandates, no exceptions or substitutions to the performance specification are allowed.
 - B. The system model shall be laid out in one drawing/view and in a manner that provides for easy viewing of all analysis results. The one drawing/view requirement ensures that problem areas

SECTION 26 05 73 SHORT CIRCUIT STUDY

found and highlighted by the program are easily seen and not hidden or buried in multiple drawings, eliminating potential human errors where multiple drawing verification is required.

- 1. All one-line symbols shall be spaced properly to facilitate viewing results on the one-line.
- 2. Equipment names used in the modeling software shall be identical to the equipment and naming convention shown on the construction document drawings and equipment unless conflicts exist.
- C. Short Circuit Study
 - 1. Comply with IEEE 399.
 - 2. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
 - 3. Computer software program shall report device ratings of all overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system requirements and other conditions affecting performance. Proceed with final studies and analysis only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to study may not be used in the final study.
- B. Actual field data collection shall be performed by a qualified (as defined by NFPA 70E) consultant/contractor to ensure accurate equipment modeling.
- C. Equipment shall be visually inspected to collect the necessary nameplate data used in the analysis. Consultant/contractor is responsible for visual verification of this data, including transformers, breakers, etc. Data that may not have nameplate data such as conductors, etc. can be taken from drawings. Conductor lengths shall be field verified.

3.2 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support study:
 - 1. Impedance of utility service entrance.
 - 2. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Equipment name, type, voltage, and rating.
 - b. Circuit-breaker and fuse-current ratings and types.
 - c. Relays and associated power and current transformer ratings and ratios.
 - d. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - f. Motor horsepower and code letter designation according to NEMA MG 1.
 - 3. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Ratings, types, and settings of utility company's overcurrent protective devices.
 - e. Special overcurrent protective device settings or types stipulated by utility company.
 - f. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes RMS symmetrical.

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3.3 SHORT CIRCUIT STUDY

- A. Calculate the maximum available short-circuit current in amperes RMS symmetrical at circuitbreaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 - 1. Branch circuit panelboards
 - 2. Air conditioning and refrigeration equipment
- B. Study electrical distribution system from normal power sources throughout electrical distribution system affected by the Project.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.
 - 1. Transformers: 1EEE C57.12.00.
 - 2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 - 3. Low-Voltage Fuses: IEEE C37.46.
- E. Study Report:
 - 1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- F. Equipment Evaluation Report:
 - 1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
 - 3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 4. A report of all problem areas shall be provided. Consultant/contractor shall notify A/E immediately of all problems found in this system before proceeding in the study.
 - 5. A preliminary action list shall accompany preliminary report submitted with shop drawings.
 - 6. A recommended action list shall be provided for all underrated equipment in the system.

3.4 LABELING

Α.

- Short Circuit Current Labels
 - 1. Provide labels on all electrical equipment included in the study, but at a minimum at the service entrance equipment, indicating the maximum available short circuit fault current, including the date the fault current calculation was performed and the clearing time of service overcurrent protective devices at the service equipment. Label must be of sufficient durability to withstand the environment in which it is installed. Apply labels to associated equipment in locations where label can be easily read.
 - 2. Label service equipment per 2020 NEC 110.16(B).
 - 3. Label all panels with AIC per 2020 NEC 408.6.
 - 4. Label all air conditioning and refrigeration equipment per NEC 440.10.

END OF SECTION 26 05 73

SECTION 26 05 73 SHORT CIRCUIT STUDY

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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. Lighting and appliance branch-circuit panelboards.
- 2. Calculations of maximum available fault current.
- 3. Surge Protective Devices (SPD).

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 6. Surge Protective Devices (SPD): Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). The submittal shall contain the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).
- C. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Submit available fault current calculations for service equipment (or each panelboard) as described in this section.

1.4 CALCULATIONS OF MAXIMUM AVAILABLEFAULT CURRENT

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at service equipment and each panelboard of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit. Coordinate available fault current from the serving Utility, transformer impedance, installed conductor length, etc for actual values. Label per Section 26 05 53 Identification for Electrical Systems.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. 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.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).

1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate installation locations of panelboards with Divisions 21, 22, and 23. The drawings diagrammatically show electrical gear, ductwork, piping, etc. The Contractors shall coordinate on site for actual installation locations. Ducts, piping, etc cannot be installed over panelboards.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

- 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- 4. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
- 5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. All space provisions and unused space to be fully prepared for future circuit breakers including mounting kits.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only as indicated on schedule.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 LOAD CENTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Load Centers: Comply with UL 67.
- C. Mains: Lugs only.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
- 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
- 3. Siemens Energy & Automation, Inc.
- 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - **1.** Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (4-6-mA trip).
 - 3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip). Where service equipment is more than 150 volts to ground and rated more than 800 amperes.
 - 4. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration. All 120V, 1-phase, 15 and 20 amp circuits in Dwellings shall be protected by arc-fault circuit breakers
 - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Where noted on drawings or where required by NEC.
 - d. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.5 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Current Technology; a subsidiary of Danahar Corporation.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 4. Liebert Corporation.
 - 5. Siemens Energy & Automation, Inc.
 - 6. Square D; a brand of Schneider Electric.
- B. Surge Protective Devices (SPD)]: The SPD applications covered under this section include distribution panelboards, lighting and appliance branch-circuit panelboards, electronic grade panelboards and switchboards. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments. IEEE C62.41, integrally mounted, solid-state, and parallel-connected. SPD Type all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 2 SPDs.
 - 1. General Requirements:
 - a. Units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).
 - b. Unit Operating Voltage Refer to drawings for operating voltage and unit configuration.
 - c. Maximum Continuous Operating Voltage (MCOV) The MCOV shall not be less than 150Vrms (120/208V) and 320Vrms (277/480V) of the nominal system operating voltage.
 - d. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon

avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

- e. Protection Modes: The SPD must protect all modes of the electrical system being utilized.
- f. Nominal Discharge Current (In): All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
- g. Balanced Suppression Platform: The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
- h. Electrical Noise Filter: Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
- i. Internal Connections: No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
- j. Monitoring Diagnostics: Each SPD shall provide the following integral monitoring options:
 - Protection Status Indicators Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - Remote Status Monitor The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
 - 3) Audible Alarm and Silence Button The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
 - 4) Surge Counter The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
- k. Overcurrent Protection: The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
- I. Fully Integrated Component Design: All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
- m. Safety Requirements: The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs

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requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

- n. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
 - 1) SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
 - 2) The panelboard shall be capable of re-energizing upon removal of the SPD.
 - 3) The SPD shall be interfaced to the panelboard via a direct bus bar connection.
 - 4) The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
 - 5) The SPD shall be of the same manufacturer as the panelboard.
 - 6) The complete panelboard including the SPD shall be UL67 listed.
- 2. Peak Single-Impulse Surge Current Rating: Minimum surge current capacity: 60 kA per mode/120 kA per phase.
- ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed: 700 V for L-N, L-G, and N-G and 1200 V for L-L on 208Y/120 V. 1200 V for L-N, L-G, and N-G and 2000 V for L-L on 480Y/277 V.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Mount top of trim 78 inches (2286 mm) above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated:
 - 1. Backboards: Mount cabinets, lighting and appliance branch-circuit panelboards, disconnect switches, and control enclosures on plywood, fire-retardant treated, painted (gray), 3/4 inch. Comply with requirements for plywood backing panels specified in Division 6 Section "Rough Carpentry."
- F. Install overcurrent protective devices and controllers not already factory installed.
- 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.

SECTION 26 24 16 PANELBOARDS

- H. For recessed/flush panelboards stub six 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space (or space designated to be ceiling space in the future).
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- J. Comply with NECA 1.
- K. Provide lockable breaker device for fire alarm and hand dryers.
- L. All homerun conduits shall terminate directly into the top of panelboards and not have a wireway with nipple conduits between panelboard and wireway. Multiple splices (wirenuts) in a gutter above panels will not be allowed.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Provide label on each panelboard indicating where their source of supply is located, per the NEC 408.4(B). Provide label complying with requirements of Division 26 Section "Identification for Electrical Systems."
- E. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Provide documentation to demonstrate that the method chosen to reduce clearing time is set to operate at a value below the available arcing current per NEC 240.87.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Engineer's Observations: This Contractor shall open/remove panel covers for observation of panels by Engineer.
- 3.5 ADJUSTING
 - A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
 - B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 26 24 16

SECTION 26 24 16 PANELBOARDS

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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

Β.

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - Related Sections include the following:
 - 1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR5362.
 - b. Hubbell; BR20TR.
 - c. Leviton; TBR20.
 - d. Pass & Seymour; TR5362.
 - 2. Provide tamper-resistant receptacles in dwelling units (NEC 406.11) and in children's play areas within commercial facilities.
- B. Special Use Receptacles (dryer), 125/250V, 30 A, 3-pole, 4-Wire: Comply with NEMA WD 1, NEMA WD 6 configurations 14-30R and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5744N
 - b. Hubbell; HBL9430A
 - c. Leviton; 278
 - d. Pass & Seymour: 3864

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles with Tamper-Resistant, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; GFTRST20.
 - b. Leviton; GFTR2.
 - c. Pass & Seymour; 2097TR.
 - 2. Provide self-test GFCI.
 - 3. Provide weather resistant receptacles where installed in wet locations:
 - a. Hubbell; GFTWRST20.
 - b. Leviton; GFWR2.
 - c. Pass & Seymour; 2097TRWR.
- C. Faceless GFCI convenience receptacles, 115V, 20A:
 - 1. Products: Subject to compliance with requirements provide one of the following:
 - a. Feed thru receptacles shall be similar to above except no receptacle plug-ins and similar to Hubbell GFBFST20.

2.4 USB CHARGER/RECEPTACLE

- A. General Description: Combination AC duplex receptacles with two 5-volt DC USB ports one Type-A port and one Type-C port, that work with USB 2.0 and 3.0 compatible devices. Straight blade receptacle. Comply with UL 498, UL 1310, and Fed Spec WC596.
- B. Tamper-Resistant, Convenience Receptacles with two USB chargers one Type-A port and one Type-C port, 125 V, 20 A:
 - 1. Basis of design:
 - a. Legrand R2USBAC6WCCV6.
- C. Provide GFCI, USB, and TR receptacle where shown on plans.
- 2.5 ARC FAULT RECEPTACLES
 - A. Products: Subject to compliance with requirements, provide one of the following:
 1. Cooper.

- 2. Hubbell.
- 3. Leviton.
- 4. Pass & Seymour.
- B. Arc-fault circuit interrupter per UL 1699. Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit.

2.6 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.
- 2.7 SNAP SWITCHES

1.

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; 1221 (single pole), 1222 (two pole), 1223 (three way), 1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).

2.8 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. LED Lamp Dimmer Switches: Modular; compatible with fixture driver; trim potentiometer to adjust low-end dimming; dimmer-driver combination capable of consistent dimming with low end not greater than 5 percent of full brightness.
 - 1. Solid state triac dimming.
 - 2. Flicker free, smooth, continuous dimming.
 - 3. Equivalent to Leviton Renoir II pre-set slide dimmers for three-way dimmers for multilocation dimming.
- 2.9 WALL PLATES
 - A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material: 0.035-inch- (1-mm-) thick, 302 stainless steel.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in "wet locations."
 - B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weatherresistant, die-cast aluminum with while-in-use, gasketed, extra-duty, lockable cover. Covers shall be Hubbell #WP26E series, or equivalent.

2.10 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

- 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
- 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
- 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- 4. Provide the grounded conductor at the switches controlling lighting loads.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.

- 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- 4. Install wall dimmers to achieve indicated/required rating after derating for ganging as instructed by manufacturer.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- J. Receptacle outlets shall accommodate connection of attachment plug of associated equipment.
- K. Install blank faceplate on any j-box not having a device.
- L. Provide tamper-resistant receptacles in all dwelling units and guest rooms.
- M. Provide GFCI protection for receptacles in kitchens, at water coolers, within 6' of sink, outdoors, and where otherwise indicated on Drawings.
- N. Provide weatherproof covers at all exterior receptacles, at interior wet or spray locations, and where otherwise indicated on Drawings.
- O. GFCI receptacles shall not be installed behind equipment (refrigeration, vending, at water coolers, etc). Place receptacle where cord is accessible or provide the ground fault protection at the breaker.
- 3.2 IDENTIFICATION
 - A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use permanent marker inside outlet boxes. Provide stick on label with panelboard and circuit number to faceplate of receptacle.
- 3.3 FIELD QUALITY CONTROL
 - A. Perform tests and inspections and prepare test reports.
 - 1. In all facilities, prepare reports, or indicate on as-builts drawings, the conductors being up-sized due to voltage drop. Indicate length of conductors, calculated load (amperage or wattage), and conductor size.
 - B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Voltage Drop: See Specification Section 26 05 19. Voltage drop higher than 3 percent is not acceptable.
 - 3. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 4. Using the test plug, verify that the device and its outlet box are properly wired and securely mounted.
 - 5. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 27 26 WIRING DEVICES

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SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches (FS).
 - 2. Nonfusible switches (NF).

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers. Retain first paragraph below if Contractor is responsible for field quality-control testing and inspecting.
- C. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. 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.
- D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
- 2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
- 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
- 3. Siemens Energy & Automation, Inc.
- 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.

SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION
 - A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
 - B. Install fuses in fusible devices.
 - C. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Field Service: Engage a representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION 26 28 16

SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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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. Interior lighting fixtures.
 - 2. Emergency lighting units.
 - 3. Lighting fixture supports.

1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. CU: Coefficient of utilization.
- C. LED: Light Emitting Diode.
- D. LER: Light Fixture efficacy rating.
- E. Light Fixture: Complete lighting fixture, including ballast housing if provided.
- F. RČR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

- 1. Physical description of lighting fixture including dimensions.
- 2. Emergency lighting units including battery/driver and charger.
- 3. Energy-efficiency data.
- 4. Life, output, and energy-efficiency data.
- 5. LED Fixture Reports
 - a. IESNA LM-79 Test Reports.
 - b. IESNA LM-80 Test Reports.
 - c. IESNA TM-21 Calculation.
- B. Shop Drawings: Show details for each fixture.
- C. Provide documentation on BABAA compliance.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - 1. Tabulated list of light fixture types, associated lamps, and associated LED modules.
 - 2. Submitted light rebate form to local Utility.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- 1.6 COORDINATION
 - A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
 - B. Coordinate with and help Owner in submitting available lighting rebates to local Utility.

1.7 WARRANTY

- A. Special Warranty for LED Modules: Provide all materials and labor necessary to replace components that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Five year(s) from date of Substantial Completion.
- B. Provide written copy of manufacturer's warranty with lighting submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the manufacturers specified or pre-bid approved equivalent:
 - 1. Light Fixtures:
 - a. Refer to Lighting Fixture Schedule on Drawings.
- 2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS
 - A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
 - B. LED Fixtures: Comply with UL 8750 and UL 1598.
 - C. Metal Parts: Free of burrs and sharp corners and edges.
 - D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
 - E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
 - F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
 - G. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 LED (LIGHT-EMITTING DIODE)

- A. LEDs, driver, and advanced optical design.
- B. Approximately 96 percent optical efficiency.
- C. Reflector sealed to the LED chip package for uniform illumination. Reflector shall reduce light loss and deliver superior light control. Reflector shall control glare.
- D. High efficiency driver and thermal management system capable of providing total luminaire efficiencies in excess of 50 lumens per watt.
- E. Fixture shall include frame-in kit for construction being installed in.
- F. Proper thermal management with heat sinks.
- G. Fixture shall be Listed with Energy Star or Designlights Consortium.
- H. Drivers: General Requirements:
 - 1. Efficiency per LM-79:
 - a. Drivers capable of 50 watts or greater: 85 percent or higher
 - b. Drivers capable of less than 50 watts less: 80 percent or higher
 - 2. Power Output: UL Class I or II output.
 - 3. Rated Driver Life: Shall match Light Engine Rated Life; 50,000 hours minimum.

- 4. Operating Frequency: 60 Hz
- 5. Power Factor: 0.90 or higher.
- 6. Total Harmonic Distortion Rating: Less than 20 percent.
- 7. Sound Rating: Class A
- 8. Hazardous Substances: RoHS compliant.
- 9. Operations:
 - a. On/Off: Shall be rated for normal 120V or 277V switch operation as indicated on drawings.
 - b. Dimming: Shall be compatible with industry standard dimming protocols.
- 10. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
- 11. Radio Frequency Interference: Comply with FCC 47 CFR part 15 Class A (commercial).

2.4 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

- 1. Battery: Sealed, maintenance-free, lead-acid type.
- 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
- 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- 6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
- 7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
- 8. Integral Self-Test: Factory-installed electronic device automatically initiates coderequired test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
- 2.5 LED MODULES
 - A. Lumen Output: As indicated on the fixture schedule.
 - B. LED Binning: Within a 3-step MacAdam ellipse.
 - C. Rated Module Life: Greater than 70 percent of initial lumens at 50,000 hours, per LM-79 and LM-80 testing.
 - D. Correlated Color Temperature (CCT): As indicated on the drawings with an allowed plus or minus 5% variance.
 - E. Color Rendering Index (CRI): As indicated for the specified CCT:
 - 1. CCT of 3000K to 3500K: Greater than or equal to 80.
 - 2. CCT of 4000K to 6500K: Greater than or equal to 70.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channeland angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: The grid shall not be used as a support element. Contractor shall support fixtures independently from structure.
 - 1. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - 2. Install at least two independent support rods or wires from structure to a tab on lighting fixture at opposite ends of the fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- D. Install contactors and low-voltage track lighting transformers in NEMA 1 enclosures.
- E. Light fixtures with the letters NL are to be used as night lights and be unswitched.
- F. Circuits feeding exit signs and emergency lighting shall be unswitched hot from associated room.
- G. Emergency fixtures that are switched require switched circuit(s) and a constant hot for the emergency battery ballast unless it is used as a night light.

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.3 UTILITY REBATES

- A. Coordinate with and help Owner in submitting available lighting rebates to local Utility.
- B. Submit form for Owner.

END OF SECTION 26 51 00

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. Exterior luminaires.
 - 2. Luminaire-mounted photoelectric relays.

1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. Luminaire: Complete lighting fixture, including ballast housing if provided.
- C. Pole: Luminaire support structure, including tower used for large area illumination.
- D. Standard: Same definition as "Pole" above.

1.4 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts/drivers, and accessories.
 - 6. Photoelectric relays.
 - 7. Ballasts/drivers, including energy-efficiency data.
 - 8. Lamps, including life, output, and energy-efficiency data.
- B. Shop Drawings:
 - 1. Show details for each fixture.
 - 2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

1.6 WARRANTY

- A. Special Warranty: Provide all materials and labor necessary to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. Subject to compliance with requirements, provide products by one of the manufacturers specified or pre-bid approved equivalent:
 - 1. Light Fixtures:
 - a. Refer to Lighting Fixture Schedule on Drawings.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- F. Exposed Hardware Material: Stainless steel.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- H. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- I. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- K. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
 - 1. Relay with locking-type receptacle shall comply with NEMA C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.4 LED

- A. LEDs, driver, and advanced optical design.
- B. Approximately 96 percent optical efficiency.
- C. Direct-contact refractor sealed to the LED chip package for uniform illumination. Refractor shall reduce light loss and deliver superior light control. Refractor shall control glare.
- D. High efficiency driver and thermal management system capable of providing total luminaire efficiencies in excess of 70 lumens per watt.
- E. Modular light bars.

F. Proper thermal management with heat sinks and vented housing for continual air flow through fixture.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.
- D. Exterior building fixtures shall be sealed with weatherproof caulking (color match face of building). Fixture locations and mounting heights shall be coordinated with architectural elevations and details.

3.2 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.3 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole, unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.4 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 56 00

SECTION 26 56 00 EXTERIOR LIGHTING

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SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

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. Pathways.
 - 2. Coaxial cable.
 - 3. Cabling system identification products.

1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
- D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference.
- G. IDC: Insulation displacement connector.
- H. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- I. LAN: Local area network.
- J. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- K. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- L. RCDD: Registered Communications Distribution Designer.
- M. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.
- N. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.
- O. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
 - 4. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m) and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.
- 1.6 SUBMITTALS
 - A. Product Data: For each type of product indicated.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
 - B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration drawings and printouts.
 - C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
 - D. Source quality-control reports.
 - E. Field quality-control reports.
 - F. Maintenance Data: For splices and connectors to include in maintenance manuals.
 - G. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
- 1.7 QUALITY ASSURANCE
 - A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
 - Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
 - C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
 - D. 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.
 - E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
 - F. Grounding: Comply with ANSI-J-STD-607-A.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

Β.

SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.9 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.10 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.
 - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Alpha Wire Company.
- 2. Belden CDT Inc.; Electronics Division.
- 3. Coleman Cable, Inc.
- 4. CommScope, Inc.
- 5. Draka USA.
- B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-6/U: NFPA 70, Type CATV or CM.
 - 1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - 3. Jacketed with black PVC or PE.
 - 4. Suitable for indoor installations.
- D. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
 - 1. CATV Cable: Type CATV.

SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

- 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
- 3. CATV Riser Rated: Type CATVR complying with UL 1666.
- 4. CATV Limited Rating: Type CATVX.

2.4 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aim Electronics; a brand of Emerson Electric Co.
 - 2. Leviton Voice & Data Division.
 - 3. Siemon Co. (The).
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.5 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-B and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

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- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches (76 mm) above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.
- 3.4 INSTALLATION OF CABLES
 - A. Comply with NECA 1.
 - B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - 11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
 - C. Group connecting hardware for cables into separate logical fields.
 - D. Separation from EMI Sources:
 - 1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 - 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).

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- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- 4. 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:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- 3.5 FIRESTOPPING
 - A. Comply with requirements in Division 07 Section "Penetration Firestopping."
 - B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 - C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-B. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-B for Class 2 level of administration.
- D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-B. Furnish electronic record of all drawings, in software and format selected by Owner.
- F. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

- 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
- 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
- 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- 6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-B.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 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. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 27 15 00

SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

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DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 11 DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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. Fire alarm s

Fire alarm system extension:

- 1. This Contractor shall furnish, install and place into operation a complete electronically operated, Closed Circuit, Fire Alarm System as described herein and shown on the plans.
- 2. All components of the system shall be U.L. listed for their intended use. Control panels, detectors, signal devices and other field devices shall all bear the appropriate U.L. fire label.
- 3. Carbon monoxide detection shall be provided per IFC 915.
- B. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors
 - 4. Notification appliances.
 - 5. Remote annunciator.
 - 6. Addressable interface device.
 - 7. Digital alarm communicator transmitter.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. The Contract Document drawings are intended to show conceptual design only. This contractor shall layout system devices per spacing and coverage limitations of the proposed equipment. Full design of fire alarm system and all associated components needed to create a complete and operational system shall be completed by NICET certified professional, minimum Level III.

1.6 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Submittals to Authorities Having Jurisdiction (AHJ): In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. The submittal shall be created by this Contractor, and contain all documents required by the AHJ, in the requested format. Contract Document drawings created for bid package shall NOT be used for submittals, as they indicate conceptual design only. This Contractor shall verify design and system layout per coverage and spacing limitations of proposed equipment, in accordance with NFPA 72. Submittal plans shall be created by this Contractor using standard symbols provided in most current edition of NFPA 170, not symbols on Construction Documents. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

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- 3. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Fire alarm certified by NICET, minimum Level III.
 - 2. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 3. Include voltage drop calculations for notification appliance circuits. Use end-of-line (EOL) method of calculating voltage drop.
 - 4. Include battery-size calculations.
 - 5. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 - 6. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 - 7. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 8. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 - 9. Include alarm signaling-service equipment, rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 - a. Submit pre-recorded messages for building evacuation.
 - 10. Include floor plans to indicate final outlet locations showing address of each addressable device and intensity of visual alarm. Show size and route of cable and conduits.
 - 11. Fire Sprinkler devices: Coordinate locations of flow switches, tamper switches, dry system air compressors, sprinkler head quantities (for heat detector requirements), OS&Y/Fire Department Connection and other devices with fire sprinkler contractor and show devices on submittals.
- D. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 - 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
- E. Qualification Data: For qualified Installer.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
SECTION 28 31 11 DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

- 3. Record copy of site-specific software.
- 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
- 5. Manufacturer's required maintenance related to system warranty requirements.
- 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- 7. Copy of NFPA 25 (this is fire sprinkler).
- H. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
- I. Documentation:
 - 1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
 - 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Owner, Architect, and authorities having jurisdiction.
 - b. Electronic media may be provided to Architect and authorities having jurisdiction. Verify format with AHJ, prior to submittal.
- 1.7 QUALITY ASSURANCE
 - A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
 - B. Installer Qualifications: Contractor must be a certified installer by the State.
 - C. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
 - D. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
 - E. 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.
 - F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.8 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Fire Lite Alarms; a Honeywell company.

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2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Smoke detectors.
 - 3. Combination smoke/carbon monoxide detectors.
 - 4. Verified automatic alarm operation of smoke detectors.
 - 5. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm at fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. Duct smoke detectors.

D.

- System trouble signal initiation shall be by one or more of the following devices and actions:
- 1. Open circuits, shorts, and grounds in designated circuits.
 - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of primary power at fire-alarm control unit.
 - 4. Ground or a single break in fire-alarm control unit internal circuits.
 - 5. Abnormal ac voltage at fire-alarm control unit.
 - 6. Break in standby battery circuitry.
 - 7. Failure of battery charging.
 - 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
 - 9. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
 - 1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder.
 - 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Circuits:
 - 1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - a. Initiating Device Circuit: Class B.
 - b. Notification Appliance Circuits: Class B.
 - c. Signaling Line Circuits: Class B.
 - d. Install addressable devices on each signaling line circuit so no more than 75 percent of circuit is used.

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- 2. Serial Interfaces: Two RS-232 ports for printers.
- D. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Record events.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- E. Notification Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.
- F. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.
- G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.
- H. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the powersupply module rating.
 - 2. Provide power source to horn expanders as required.
 - 3. Power supply shall have a dedicated circuit and circuit breaker lock. Label overcurrent device with red label "FIRE ALARM SYSTEM."
- J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead acid calcium.
- K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- L. Surge protection
 - 1. Install surge protection on normal ac power for the FACP and its accessories.
 - 2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.

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2.5 SYSTEM SMOKE DETECTORS

Α.

General Requirements for System Smoke Detectors:

- 1. Comply with UL 268; operating at 24-V dc, nominal.
- 2. Detectors shall be two-wire type.
- 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
- 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
- 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Combination Smoke/Carbon Monoxide Detectors:
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 - 3. In dwelling units and sleeping units, combination smoke/carbon monoxide alarms with sounder base shall be provided in lieu of detectors.

2.6 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
 - B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a singlemounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
 - C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

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- D. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
- E. The same audible notification devices can be used for systems consisting of both fire alarm and carbon monoxide detection devices, provided carbon monoxide audible signal is a distinctive pattern per NFPA 72.
- F. Color: Factory finished, white with red lettering or as required by Local Code.

2.7 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
- C. Provide brushed aluminum trim.

2.8 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Provide a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.
- C. Control Module/Relay: Shutdown all motors (air moving fans, fan powered terminal units, large circular (ceiling) air movement fans, VAV's, etc) that have shutdown requirements. Provide a control module relay at each motor starter and interlock starter to fire alarm system to shut down on (general) alarm.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER (CELLULAR COMMUNICATOR)

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from firealarm control unit and automatically dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal. Transmitter shall automatically report telephone service restoration to the central station.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that telephone line is available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.

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- 4. Loss of ac supply or loss of power.
- 5. Low battery.
- 6. Abnormal test signal.
- 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.10 FIRE ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Comtran Corp.
 - 2. Draka USA.
 - 3. Genesis Cable Products; Honeywell International, Inc.
 - 4. Rockbestos-Suprenant Cable Corporation.
 - 5. West Penn Wire/CDT; a division of Cable Design Technologies.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted-pair, not less than No. 18 AWG shielded or unshielded in accordance with manufacturer's recommendations for the various installation applications associated with this project, sizes as recommended by system manufacturer, and classified for power-limited fire alarm signal service.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit on finished floor with top of cabinet not more than 72 inches (1830 mm) above the finished floor.
- C. Smoke- or Heat-Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - 3. Smooth ceiling spacing shall not exceed 30 feet (9 m) and/or the rating of the detector.
 - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 - 5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
 - 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- D. Smoke detector above Fire Alarm Panel: Locate smoke detector(s) above fire alarm panel. Provide minimum of one detector. Spacing shall conform to coverage in space above panel.
- E. Provide manual pull station in AHJ approved location.

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- F. Horn Expanders: Provide power source for horn expanders as required. Locate smoke detector(s) above all horn expanders. These locations are not shown on the Drawings. Spacing shall conform to coverage in space above panel.
- G. Post Indicating Valve: Provide monitoring of the PIV located outside the building.
- H. OS&Y/Fire Department Connection: Provide an audible/visual notification appliance at the fire department connection. Coordinate exact rough-in location with fire sprinkler contractor.
- I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- J. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- K. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
- M. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- N. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- O. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Supervisory connections at valve supervisory switches.

3.3 WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method:
 - 1. Signaling Circuits: Power-Limited Fire Alarm (PLFA) cabling may be installed where approved by local and state AHJs. If not approved, wiring shall be installed in metal raceways according to Division 26 Section "Raceway and Boxes for Electrical Systems."
 - 2. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable. Cable tray is not considered a raceway.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as non-power-limited circuits.
- C. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."
 - 1. Exception: Use of plenum-rated 2-hour, fire-rated fire alarm cables, per NFPA 70, Article 760, is permitted only where concealed above accessible ceiling assemblies. Cabling shall be installed in conduit up to accessible ceiling space.
 - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

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- D. Wiring Method:
 - 1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable. Cable tray is not considered a raceway.
 - 2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as non-power-limited circuits.
- E. Device Mounting: All fire alarm devices (detectors, horns, strobes, speakers, and the like) shall be mounted on a junction box, whether on the ceiling or in the wall. Devices on walls shall have junction box with conduit stubbed up to an accessible location above the ceiling. All conduit ends shall have a bushing.
- F. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- G. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made. Cable taps must be in a box, and not open to the environment.
- H. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Colorcode audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- I. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- J. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 COORDINATION

A. Coordinate locations of flow switches, tamper switches, post indicating valve (PIV), dry system air compressors, sprinkler head quantities (for heat detector requirements), and other devices with fire sprinkler contractor BEFORE submitting bid.

3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections and to assist in field testing.
- C. Tests and Inspections:

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- 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
- 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
- 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
- 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
- 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures and Demonstration and Training."

END OF SECTION 28 31 11

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DIVISION 31 - EARTHWORK

SECTION 31 10 00 CIVIL ENGINEERING SITE WORK DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of Civil Engineering Site Work Demolition work is shown on the Civil Engineering drawings or specified herein in this and other sections.
- B. Civil Engineering Site Work Demolition includes, but is not limited to, removal and disposal of concrete and asphalt materials, water lines and appurtenances, trees, bushes, stumps, and removal and demolition of other miscellaneous items as shown on the drawings and as specified herein. Contractor to verify extent of required work.
- C. Demolition includes abandonment of existing underground utilities in place as shown in the drawings or specified herein.
- D. Refer to Electrical and Mechanical drawings and specifications for additional demolition items.
- E. Refer to Earthwork specifications for excavation and backfill work required for demolition.

1.2 SUBMITTALS

- A. Submit copies of existing condition documentation required by 1.4.B
- B. Submit demolition and coordination schedule and plan as required by 1.4.C

1.3 JOB CONDITIONS

- A. Explosives: The use of explosives will not be permitted.
- B. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
- C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities and persons.
- D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to the Owner.
- E. Utility Services: Maintain existing utilities and protect against damage during demolition operations. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Owner's Project Representative. Provide temporary services during interruptions to existing utilities, as acceptable to the Owner.

1.4 GENERAL REQUIREMENTS

- A. Authorization Do not begin demolition until authorization is received for each item of demolition.
- B. Existing Conditions Documentation Document existing conditions with photographs prior to beginning demolition. Record existing damage and conditions of items which are to remain prior to beginning demolition.
- C. Schedule demolition work in sequence and in overall coordination with other project demolition and construction requirements. Owner's Project Representative approval of demolition sequence of operations and coordination required.
- PART 2 PRODUCTS
- 2.1 NOT APPLICABLE
- PART 3 EXECUTION

3.1 DEMOLITION

- A. Pollution Controls: Use water sprinkling and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulation pertaining to environmental protection.
- B. As indicated on the drawings, specified herein, or required to facilitate the work under this contract, the following items shall be removed from within the project limits unless otherwise noted on the plans to remain.

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SECTION 31 10 00 CIVIL ENGINEERING SITE WORK DEMOLITION

- 1. Existing asphalt pavement. Straight saw cutting of edges is required.
- 2. Portland cement concrete items. Concrete pavements, curbs, slabs, building floors, stoops, sidewalks, pads, pans, blocks, walls, foundations, and other portland cement concrete items. Curb and gutter and sidewalks to be removed to nearest joint or sawed as approved by Engineer. Footings and foundations to be removed full depth unless otherwise noted.
- 3. Landscaping items as indicated on the drawings. Trees and shrubs shall not be removed without prior authorization from the Owner's Project Representative. Protect trees and shrubs not being removed.
- 4. Signs, sign posts, delineators, and bollards.
- 5. Fences and guardrails, including posts and foundations.
- 6. Water, storm sewer, and sanitary sewer items. Underground piping is to be abandoned in place unless otherwise noted on drawings. Remove abandoned water, sewer, and sanitary sewer pipe when exposed by excavation and plug remaining ends.
- 7. Miscellaneous items as shown on the drawings.

3.2 DISPOSAL OF DEMOLISHED MATERIALS:

A. Unless otherwise noted for salvage, remove debris and demolished materials and dispose of at Contractor furnished waste disposal site.

END OF SECTION 31 10 00

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of the earthwork is shown on the drawings and includes but is not limited to general site grading, excavation, and filling, disposal of waste excavated material if necessary, furnishing of borrow material if necessary, excavating, trenching, backfilling and compacting for water main construction, required grading and filling for demolition items, and other miscellaneous items to the lines and grades shown on the drawings.

1.2 QUALITY ASSURANCE

- A. Testing A testing agency will be retained by the Contractor to complete the required testing as outlined in these specifications. The Contractor shall coordinate testing schedules with the testing agency. Any testing not specifically called out to be provided by the Owner shall be assumed to be the responsibility of the Contractor.
- B. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.3 JOB CONDITIONS

- A. Geotechnical Reports: No geotechnical exploration was completed for the project.
- B. Site Examination: The Contractor shall examine the site and drawings to familiarize himself with the work to be done and conditions to be encountered. Prior to bidding and with approval of the Owner, the Contractor may make his own subsurface investigations to satisfy himself with site and subsurface conditions.
- C. For work areas in and along the streets or parking lots, the Contractor shall furnish, install, and use traffic control signing and devices per the requirements of the Manual on Uniform Traffic Control Devices for Streets and Highways.
- D. Operate warning lights as recommended by authorities having jurisdiction.
- E. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
- F. Protection of Existing Utilities: Existing power lines, telephone lines, trees, shrubbery, fences, water mains, water service lines, gas mains, gas service lines, sewer and sewer service lines, irrigation lines, fiber optic cables, conduits, ditches, embankments, power poles, light poles, storm sewers, drop inlets and other structures in the vicinity of the work not authorized to be removed shall be supported and protected from injury by the Contractor during the construction and until completion of the work affecting them. The Contractor shall be responsible for having all utilities located prior to beginning construction. The Contractor shall be liable for all damages done to such existing facilities and structures as herein provided and shall save the Owner harmless from any liability or expense for injuries, damages, or repair to such facilities. The Contractor shall have all underground utilities located prior to beginning site grading or excavating.
- G. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult Owner's Project Representative immediately for directions. Repair damaged utilities to satisfaction of utility owner at no cost to the Owner.
- H. Use of Explosives: The use of explosives is not permitted without prior authorization from the Owner and the Fire Department.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Segregation shall be performed to exclude unsatisfactory materials, organic materials, oversize rock, blocky material, or other materials as deemed by the Owner's Project Representative to be unsuitable for fill materials. Rock materials in the onsite materials used for site grading under pavements shall have a maximum particle size no larger than 6" in the maximum

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SECTION 31 20 00 EARTHWORK

dimension and the rock containing materials are to be placed under the observation of the Owner's Project Representative.

- B. Satisfactory borrow materials, if necessary, shall be furnished by the Contractor and shall comply with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, and CL. Maximum particle size shall be 6". The imported borrow material shall be approved by the Owner's Project Representative.
- C. Unsatisfactory soil materials are those soils not meeting the requirements of satisfactory soil materials in 2.1.A through 2.1.B. Frozen materials are considered unsatisfactory soil materials. The unsatisfactory materials shall be disposed of by the Contractor.
- D. Unstable materials consist of sand pockets, soft soils, and other soils which cannot support the improvements as determined by the Owner's Project Representative. Unstable materials also consist of materials too wet to properly support the improvements.
- E. Water for Compaction will be the responsibility of the Contractor.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Comply with the above referenced geotechnical reports and these specifications. In case of conflict between documents, the stricter requirements, as defined by the Geotechnical Engineer shall prevail.
- B. All excavation for the site grading and trenching is considered Unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. Material excavated at the site may be considered usable for grading and backfill purposes subject to the requirements of Part 2, Paragraph 2.1.A of these specifications.
- C. Cuts and fills are not necessarily balanced. The Contractor is responsible for calculating any quantities he needs to bid and construct the project. The Contractor is required to furnish any satisfactory borrow materials that may be required. The Contractor is required to dispose of any excess materials that may result.
- D. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner's Project Representative. Unauthorized excavation, as well as remedial work directed by the Owner's Project Representative shall be at Contractor's expense.
- E. Compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Owner's Project Representative.
- F. Stability of Excavations: Slope sides of excavations to comply with applicable codes and safety regulations. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- G. Maintain sides and slopes of excavations in safe condition until completion of backfilling. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- H. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- I. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- J. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

- K. All construction discharges are subject to the rules and regulations of the National Pollutant Discharge Elimination System General Permit for Construction Activities in the State of South Dakota.
- L. Material Storage: Stockpile satisfactory excavated materials in areas approved by the Engineer until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
- M. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
- N. Dispose of excess soil material and waste materials as herein specified.
- O. Excavation Through Pavements: Where trenches must be excavated through existing paved areas, the paving shall be saw-cut to a depth of 1 1/2 inches minimum on all sides of the excavation and the paving shall be removed along the saw-cut lines. When sawing would occur less than three feet from an existing pavement joint, the paving shall be removed back to the existing pavement joint. Pavement shall be sawed and removed so that the opening is at least 12 inches wider than the top of the trench on each side to prevent undermining of pavement.
- P. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10' and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
- Q. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Width of trench shall be as necessary for compliance with applicable codes and safety regulations and proper performance of work.
- R. Excavate trenches to depth indicated or required.
- S. Where rock is encountered in trenches, carry excavation 6" below required elevation and backfill with a 6" layer of bedding material in accordance with Section 33 1000 prior to installation of pipe.
- T. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.
- U. Do not backfill trenches until tests and inspections have been made. Use care in backfilling to avoid damage or displacement of pipe systems.
- V. Cold Weather Protection: Protect excavation bottom against freezing when atmospheric temperature is less than 35oF (1oC).

3.2 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
- B. Percentage of Maximum Density Requirements: Compact soil to not less than the percentages shown below in the Soil Compaction Criteria.
- C. Comply with the above referenced geotechnical reports and these specifications. In case of conflict between documents, the stricter requirements, as defined by the Geotechnical Engineer shall prevail.

TABLE 1 - SOIL COMPACTION CRITERIA

Placement Location	Soil Type	Moisture Content	Compaction Degree
Scarification of Subgrade Utility Trench Backfill Foundation Subgrade Foundation/Retaining Wall Backfill Payement Subgrade	Free-Draining Materials (Sand and Gravels - Less Than 8% Fines)	Workable	95% (ASTM D- 4253)
Concrete Flatwork Subgrade Engineered Fill	Cohesive Materials (Clays and Silts)	<u>+</u> 3% of Optimum	92% (ASTM D- 1557)
	Cohesionless Materials (Sands and Gravels – More Than 8% Fines)	Workable	95% (ASTM D- 1557)
Site Grading Approx. 15 Feet Away from Structures	Cohesive Materials (Clays and Silts)	+3% of Optimum	85% (ASTM D- 1557)
	Cohesionless Materials (Sands and Gravels – More Than 8% Fines)	Workable	90% (ASTM D- 1557)

- D. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations. Soil material that is too wet to permit compaction to the specified density shall be removed and replaced or scarified and air dried. Soil material that has been removed because it is too wet for proper compaction may be stockpiled or spread and allowed to dry.
- 3.3 BACKFILL AND FILL
 - A. General: The contractor shall perform all excavation, filling and backfilling shown on the drawings. Fill and backfill materials shall consist of satisfactory on-site excavated materials, or satisfactory materials furnished by the Contractor. Place satisfactory soil materials in layers to the required subgrade or finished grade elevations for each area classification listed below.
 - B. Comply with the above referenced geotechnical reports and these specifications. In case of conflict between documents, the stricter requirements, as defined by the Engineer shall prevail.
 - C. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Inspection, testing, approval and recording locations of underground utilities.
 - 2. Removal of concrete formwork.

- 3. Removal of trash and debris.
- D. Cold Weather Requirements: Frozen material shall not be used in backfill and fill. When temperatures are below 40 degrees Fahrenheit and materials are being placed for pavements and structures the fill and backfill materials shall be continuously observed and tested. Fill and backfill shall not be placed on frozen subgrades.
- E. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
- F. In cut and fill areas under pavement construction areas, the Contractor shall scarify the subgrade to a depth of not less than 8", adjust the moisture content and compact the material to the requirements specified in paragraphs 3.2.B and 3.2.C of this specification section. Scarification shall result in full processing of the soil using disks, rippers, blades, or other suitable methods such that the soil is fully mixed prior to compaction.
- G. Placement and Compaction: Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.
- H. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- I. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.
- J. Prior to placement of the aggregate base course the Engineer will visit the site and, with the assistance of the Contractor, determine if soft areas are present in the subgrade. The Contractor shall furnish heavy equipment to proof roll the areas. Soft areas shall be repaired prior to placing the aggregate base course.

3.4 GRADING AND RESTORATION

- A. General: Backfilled trenches shall be finish graded to the proper subgrade elevations shown on the drawings to match existing grades or to the satisfaction of the Owner's Project Representative.
- B. Comply with the above referenced geotechnical reports and these specifications. In case of conflict between documents, the stricter requirements, as defined by the Geotechnical Engineer shall prevail.
- C. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grade. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
- D. Adjust all manholes frames and lids, inlets, valve boxes and other utilities as needed to match the new finished grades.
- E. Finish surfaces free from irregular surface changes, and as follows:
 - 1. Subgrade under Sidewalk, Curb and Gutter, Pavement, Slabs on Grade: Finish subgrade to within ±0.05' of the bottom of the aggregate base course, gravel cushion, asphalt pavement or other material to be placed by paving contractor. Subgrade shall be "bluetop staked" for finish grading prior to placement of aggregate base course.
 - 2. Subgrade under turfed or unpaved areas: Finish areas to receive topsoil to within ±0.10' of finish grade elevations allowing for placement of topsoil.
- F. Compaction: After grading, compact the subgrade surface to the depth and indicated percentage of maximum or relative density for each area classification.
- G. Topsoil materials shall be removed and replaced in kind in the same location.

3.5 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Quality control sampling and testing as outlined below will be the responsibility of the Contractor. The Contractor shall coordinate testing schedules with the testing agency.
- B. Allow testing agency sufficient time to test subgrades and fill layers before further construction work is performed.
 - 1. Pavement, Sidewalk, and Structure Areas Make at least one field density test of subgrade for each 5,000 square feet, per 1 foot vertically.
 - 2. Areas Other Than Pavement, Sidewalk, Or Structure Areas Make at least one field density test of subgrade for each 8,000 square feet, per 1 foot vertically.
 - 3. Trenches Make at least one field density test of backfill for each 200 linear feet, per 3 foot vertically.
- C. If in opinion of Owner's Project Representative, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.6 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required moisture and density prior to further construction. No extra payment will be allowed for reconditioning or stabilization of previously tested and approved compaction areas. At the Contractors option, digouts with soil backfill and/or geotextile with cover material may be used with no extra payment being made for reconditioning of previously compacted and tested areas
- D. Where settling is measurable and observable during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

3.7 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Remove debris, trash and waste materials from the site and dispose of it in an approved manner.
- B. Excess excavated soil or unsatisfactory material shall be disposed of by the Contractor at an approved Contractor furnished disposal site.

END OF SECTION 31 20 00

SECTION 32 16 23 PORTLAND CEMENT CONCRETE SIDEWALKS AND SITE WORK CONCRETE

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. The work includes all construction of Portland Cement Concrete Sidewalks and other Site Work Concrete on a prepared surface as shown on the drawings and specified herein.
 - B. Prepared subgrade materials and aggregate base course materials are specified in the earthwork sections and aggregate base course sections of these specifications.

1.2 SUBMITTALS

- A. Material Certificates: Provide copies of materials certificates signed by materials producer and Contractor certifying that each material item complies with or exceeds specified requirements.
- B. Manufacturer's Certifications and data certifying that the following materials conform to the requirements specified:
 - 1. Concrete and concrete materials
 - 2. Reinforcing Steel
 - 3. Curing Materials
 - 4. Joint Fillers
 - 5. Joint Sealers
- C. Hot and Cold Weather Plan Submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during hot or cold weather.

1.3 QUALITY ASSURANCE

- A. Testing A testing laboratory will be retained by the Owner to complete the required testing.
- B. Base Check Refer to Section 3.2.B of this specification.
- 1.4 JOB CONDITIONS:
 - A. Grade Control: Establish and maintain required lines and elevations. Blue top staking and fine grading of aggregate base course required.
 - B. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - C. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

- 2.1 PORTLAND CEMENT CONCRETE
 - A. Portland Cement Concrete and materials shall comply with requirements for Class M6 Concrete in Section 462 of the South Dakota Department of Highways STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, 2015 Edition including Errata.
 - B. Reinforcing steel shall be epoxy coated, grade 60.
- 2.2 MISCELLANEOUS ITEMS
 - A. Forms, joint fillers, joint sealers, curing compounds, reinforcement, and all other items used with the Portland Cement Concrete for Sidewalks and Stairways shall comply with applicable requirements for curb and gutter of the South Dakota Department of Highways STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, 2015 Edition including Errata.

PART 3 - EXECUTION

- 3.1 METHODS AND CONSTRUCTION:
 - A. SIDEWALK AND OTHER SITE WORK CONCRETE Methods of construction of Sidewalk shall comply with construction requirements of Sections 651.1 through 651.3 of the South Da-

SECTION 32 16 23

PORTLAND CEMENT CONCRETE SIDEWALKS AND SITE WORK CONCRETE

kota Department of Highways STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, 2015 Edition including Errata and as noted on the drawings.

3.2 SURFACE PREPARATION:

- A. Remove loose material from compacted gravel cushion surface immediately before placing the concrete.
- B. Notify Engineer of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

3.3 FIELD QUALITY CONTROL:

- A. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C94.
- B. Slump: ASTM C143; one test for each set of compressive strength test specimens; additional test when concrete consistency seems to have changed.
- C. Air Content: ASTM C231 pressure for normal weight concrete; one for each set of concrete test specimens.
- D. Concrete Temperature: Test hourly when air temperature is 400 F (4oC) and below and when 800 F (27oC) and above and each time a set of compression test cylinders is made.
- E. Compressive Test Specimen: ASTM C 32; one set of 4 standard cylinders for each compressive strength test. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
- F. Compressive Strength Tests: ASTM C39; one set for each days pour exceeding 5 cubic yards plus additional sets for each 100 cu. yds. placed in any one day; one specimen tested at 7 days, and two specimens tested at 28 days, and one specimen retained in reserve.

3.4 REPAIRS AND PROTECTIONS:

- A. Repair or replace broken or defective concrete as directed by Engineer.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from Portland cement concrete during specified cure time. The Contractor shall provide adequate barriers, warning signs, or warning lights, etc., as required. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Sweep concrete sidewalks and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

END OF SECTION 32 16 23

SECTION 32 92 00 TURF AND GRASSES

PART 1 – GENERAL

1.1 SUMMARY

A. Work consists of preparing a seedbed, furnishing and planting seed on disturbed areas within limits of the work, and maintaining turf areas until acceptable. Items included but not limited to, are Seed, Fertilizer, Mulch, Watering, and Turf Maintenance.

1.2 REFERENCES

- A. South Dakota Department of Transportation Standard Specifications for Roads and Bridges, Current Edition, and all Supplemental Specifications and all Supplemental Specifications for Errata (SD DOT SSRB).
 - 1. Section 230 Salvaging, Stockpiling and Placing Topsoil
 - 2. Section 730 Seeding
 - 3. Section 731 Fertilizing
 - 4. Section 732 Mulching
 - 5. Section 733 Sodding
 - 6. Section 734 Erosion Control and Water Pollution Control

1.3 SUBMITTALS

- A. Topsoil nutrients test results.
- B. Seed mix: Certification in accordance with SD DOT SSRB Section 730.2.C.
- C. Fertilizer: Certification in accordance with SD DOT SSRB Section 731.2.C.
- D. Sod: Certification of grasses comprising of proposed sod.

1.4 SEASONAL LIMITATIONS

- A. Permanent seeding and sodding shall not be done between June 1 and August 1 without written authorization.
- B. After October 15, dormant seeding may be done when the ground is not frozen and condition of the soil permits preparation of a satisfactory seedbed.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Seed

- 1. Seed furnished shall be the best quality seed available for the kind and variety specified.
- 2. Seed shall comply with the requirements of the South Dakota Seed Law and be "Blue Tag" certified, governed by Federal Regulations.
- 3. Origin Limitations Seed furnished shall have been grown in South Dakota or an area comparable to South Dakota's growing conditions.
- 4. Seed Testing
 - a. Seed shall be tested within nine (9) months prior to the planting date.
 - b. Testing shall be, performed by a commercial seed testing lab or a registered member of the Society of Commercial Seed Analysts (Registered Seed Technologist).
 - c. Contractor shall furnish the Engineer with a certified test report prior to the start of seeding operations.
 - d. Seed not planted within the nine (9) month period shall be retested for dormant seed, hard seed, and germination. A new certified test report shall be furnished.
 - e. Testing shall be the responsibility of the Contractor.
- 5. Labeling
 - a. Contractor shall notify Engineer a minimum of 72 hours before seeding begins.
 - b. Contractor shall ensure seed delivered to project site is accessible for Engineer to verify each bag of seed delivered to the project bears a tag, which shows the following information:

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- 1) Name and address of supplier.
- 2) Project number for which the seed is to be used.
- 3) Suppliers lot number for each kind of seed in the mixture.
- 4) Origin (where grown) for each kind of seed.
- 5) Purity, germination, and other information required by South Dakota Seed Law for each kind of seed.
- 6) Pounds of bulk seed of each kind of seed in each bag.
- 7) Total pounds of bulk seed mixture in each bag.
- 8) Pounds of pure live seed (PLS) of each kind of seed in each bag.
- 9) Total pounds of pure live seed (PLS) mixture in each bag.
- 10) Dormant seed and hard seed.
- 6. Permanent Seed Mix (Non-Irrigated Lawn Mix):
 - 20% Blue Fescue
 - 20% Chewings Fescue
 - 20% Creeping Red Fescue
 - 20% Hard Fescue
 - 10% Perrenial Ryegrass
 - 10% NuBlue Kentucky Bluegrass
- 7. Permanent seed mix rate of application: 200# per acre
- 8. Cover Crop Seeding
 - a. Cover crop seeding is required when permanent seeding is not permitted.
 - b. Cover crop seeding shall be used only between June 1 and August 1 as a means for temporary ground cover for soil stabilization.
 - c. Seed mixture shall be in accordance with SD DOT SSRB Section 730.3.D.
 - d. Cover crop seeding is not a substitution of permanent seeding. Contractor shall plant permanent seed mixture when seasonal limitations are lifted.
 - e. Contractor shall complete cover crop seeding, if required per this specification, at no additional cost.
- B. Sod
 - 1. Shall conform to the requirements established within SD DOT SSRB Section 733.2.
 - 2. Original seed mixture shall match the seed mixture identified in Section 2.1.A.5 of this specification or Pre-approved in writing by the Engineer.
- C. Fertilizer
 - 1. Fertilizer shall be a dry, standard commercial product conforming to the South Dakota Fertilizer Law and subsequent amendments or revisions.
 - 2. Each bag or other container shall clearly show:
 - a. Net weight of the contents
 - b. Name and address of the manufacturer
 - c. Brand and grade
 - d. Guaranteed analysis of the contents showing the minimum percentages of total nitrogen available, phosphoric acid, and water soluble potash, in that order.
 - 3. Fertilizer shall be 18-46-0.
- D. Mulch
 - 1. Fiber Mulch (Preferred)
 - a. Shall conform to the requirements established within SD DOT SSRB Section 732.2
 - b. Water for fiber mulch shall be considered incidental to the mulch and no measurement or payment will be made.
 - 2. Grass Hay or Straw Mulch
 - a. Shall conform to the requirements established within SD DOT SSRB Section 732.2.A.
 - b. Mulch shall have been baled dry, in bales of approximately equal weight and shall be relatively dry when applied.

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PART 3 — EXECUTION

3.1 PLANTING REQUIREMENTS

- A. Topsoil
 - 1. Areas to be seeded shall have a minimum depth of 6 inches.
 - 2. Contractor shall prepare topsoil for planting operations by loosening, fine grading, rolling, etc.
 - 3. Contractor shall take samples of topsoil material and test soil for proper nutrients. Costs for testing shall be the Contractor's responsibility.
 - 4. Contractor shall incorporate nutrient supplements as necessary to condition soil for optimal growing conditions.
- B. Fertilizer
 - 1. Apply not more than forty-eight (48) hours prior to seeding or sodding.
 - 2. Apply at a rate of 200# per acre
 - 3. Fertilizer shall be applied in accordance with SD DOT SSRB Section 731.3.A.
- C. Within seasonal limitations, seeding shall be done as soon as finish grading of topsoil has been completed.
- D. Seed shall not be sown when the wind is strong enough to interfere with uniform seed application.
- E. Seed shall not be sown on areas under water.
- F. Equipment and Methods
 - 1. Seedbed Preparation
 - a. Lumps or clods exposed by the initial pass of tillage equipment over three (3) inches in diameter shall be broken up. The number of additional passes required breaking up lumps or clods shall be kept to a minimum. Working the soil to a fine, pulverized condition shall be avoided.
 - b. After seedbed preparation has been completed, the Contractor shall pick up and dispose of all loose stones or boulders having a vertical projection above the soil surface. Logs, stumps, brush, weeds, cables, or other foreign material, which might interfere with the proper operation of drills, mowers, or other implements, shall be disposed of by the Contractor.
 - 2. Drilling
 - a. Provide a loose planting depth of one to one and one-half (1 1 ½) inches before compaction and a final planting depth of three-fourths (¾") to one (1") inch.
 - b. On areas where a press drill cannot be operated satisfactorily, hydraulic, cyclone, knapsack hand-operated, or other broadcast type seeders may be used, when approved by the Engineer.

G. Placing Mulch

- 1. Fiber Mulch (Preferred)
 - a. Rate of application shall be 2000 lbs. per acre unless otherwise specified by the Engineer.
 - b. Excessive thickness of mulch, which will smother grass seedlings, shall be avoided.
 - c. Mulch shall be placed on a given area as soon as possible, or within 48 hours after seeding.
- 2. The rate of application shall be 4000 lbs. per acre unless otherwise specified by the Engineer.
- 3. The mulch shall be placed within forty-eight (48) hours after the seeding has been completed.
- 4. Mulching operations shall not be performed during periods of high winds, which preclude the proper placing of the mulch. The placing of mulch shall begin on the windward side of the areas to be covered.
- 5. Mulch shall be blown from a machine designed for that purpose and uniformly distributed over the seeded areas.
- 6. Mulch containing excessive moisture, which prevents uniform feeding through the machine, shall not be used.

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- 7. Bales shall be broken up and loosened as they are fed into the blower to avoid placing of matted or unbroken lumps.
- 8. Mulch shall be placed uniformly over the seeded areas with a maximum of approximately ten percent (10%) of the soil surface visible through the mulch blanket prior to mulch tiller (punching) operation.
- 9. Excessive cover, which will smother seedlings of small seeded grasses, shall be prohibited. The Engineer may order the placement of mulch on any area where protection is considered necessary to forestall erosion or encourage turf establishment.
- 10. Punching Mulch
 - a. Immediately following application, the mulch shall be punched into the soil
 - b. Push mulch into soil approximately three (3) inches with ends exposed above the soil surface.
- H. Contractor shall return to site in April/May of following year to verify growth, over-seeding will be required if ground cover is not more than 75%.

3.2 SODDING

- A. Topsoil
 - 1. Areas to be seeded shall have a minimum depth of 6 inches.
 - 2. Contractor shall prepare topsoil for planting operations by loosening, fine grading, rolling, etc.
 - 3. Contractor shall take samples of topsoil material and test soil for proper nutrients. Costs for testing shall be the Contractor's responsibility.
 - 4. Contractor shall incorporate nutrient supplements as necessary to condition soil for optimal growing conditions.
 - 5. Sodding shall be done as soon as finish grading of topsoil has been completed.

B. Fertilizer

- 1. Apply not more than forty-eight (48) hours prior to seeding or sodding.
- 2. Apply at a rate of 200# per acre
- 3. Fertilizer shall be applied in accordance with SD DOT SSRB Section 731.3.A.
- C. Sodding
 - 1. Conform to the requirements established within SD DOT SSRB Section 733.3.

3.3 TURF MAINTENANCE

- A. Establishment of Planted Turf
 - 1. Following completion of seeding operations, foot, vehicular, or equipment traffic over the seeded area shall be kept to a minimum. Areas damaged from such traffic shall be reworked and reseeded as determined by the Engineer.
 - 2. Contractor shall conduct turf maintenance until a minimum 75% ground cover has been established.
 - 3. Contractor and Engineer shall periodically review turf condition until established ground cover is acceptable.
 - 4. Maintenance shall consist of Watering, Mowing, Trimming, Weeding, Rock or Impervious Debris Removal, Topsoil Recovery and Placement, Over-Seeding, Fertilizing, and Mulching.
- B. Establishment of Sod
 - 1. Contractor shall conduct turf maintenance for a period of not less than 60 days. Should a period of 60 days not be reached due to seasonal changes the Contractor shall continue turf maintenance the following spring.
 - 2. Maintenance shall consist of Watering, Mowing, Trimming, Erosion Corrections, Sod Replacement, and Fertilizing.
- C. Watering
 - 1. Contractor shall conduct watering on a regular basis to ensure underlying soil bed remains in a moist condition for optimum vegetation growth.
- D. Mowing and Trimming

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- 1. Contractor shall maintain vegetation height at 3 inches. Vegetation shall not exceed 5 inches.
- 2. Contractor shall keep planted areas in a neat and clean appearance.
- 3. Contractor shall collect grass clippings, remove from property, and properly dispose when clippings will result in a dense mulch that will prevent the growth of grass.
- E. Weeding
 - 1. Contractor shall remove weeds within seeded and/or sodded areas to the satisfaction of the Engineer and Owner until minimum ground coverage has been obtained and accepted in writing by Engineer.
- F. Rock or Impervious Debris Removal
 - 1. Contractor shall remove rocks and other impervious debris ³/₄ inch or larger in bare areas until minimum ground coverage has been obtained and accepted in writing by Engineer.
- G. Topsoil Recovery, Placement, and Erosion Corrections
 - 1. Contractor shall recovery any topsoil that has eroded due to no vegetation or mulch coverage.
 - 2. Contractor shall fill in ruts or washouts caused by erosion of topsoil. Surface condition shall be restored to a smooth mowable surface.
 - 3. Contractor shall re-install topsoil washed out from under sod, ensure sod is properly positioned, and re-pin as needed to ensure topsoil and sod remain in place.
- H. Over-Seeding
 - 1. Contractor shall reseed any area on which the original seed has been lost or displaced.
 - 2. Contractor shall conduct reseeding of bare areas as needed at the original rate of application.
- I. Fertilizing
 - 1. Contractor shall conduct fertilizing of planted areas every four (4) weeks, at the original rate of application, until minimum ground coverage has been obtained and accepted in writing by Engineer.
- J. Sod Replacement
 - 1. Contractor shall replace any section of sod that is determined to not be actively growing, as agreed upon by Contractor and Engineer, at no additional cost to the owner.
- K. Mulching
 - 1. Contractor shall re-mulch any area on which the original mulch has been displaced as a result of excessive wind, water, or other causes and topsoil is subject to erosion.

END SECTION 32 92 00

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