CITY & BOROUGH OF YAKUTAT AIRPORT WATER SYSTEM EXTENSION

CONSTRUCTION DOCUMENTS ISSUED FOR BID

PREPARED BY
RESPEC
9109 Mendenhall Mall Rd, Ste 4
Juneau, AK 99801

PREPARED FOR
City and Borough of Yakutat
PO Box 160
Yakutat, Alaska 99689

AUGUST 2025

Project Number I0297.24002

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ADVERTISEMENT FOR BIDS

General Notice

The City and Borough of Yakutat, CBY (Owner) is requesting Bids for the construction of the following Project:

CBY Airport Water Extension

Bids for the construction of the Project will be received by the RESPEC Administrative Assistant at 2700 Gambell St Suite 500, Anchorage, AK 99503 until **September 23,2025** at **2:00 PM** local time. Sealed bids must be marked "City and Borough of Yakutat- Airport Water Main Extension. Both hand delivered and mailed bids are acceptable. Please do not email your bid. Bids received will be publicly opened and read.

The Project includes the following Work:

> This project will extend the CBY drinking water system out to the Airport properties which have been affected by PFAS contamination. It will provide 4,580-ft of 6-inch HDPE, 13,710-ft of 10-inch HDPE, 1,160-ft of 6-inch DIP and 2,550-ft of 10-inch DIP. It will provide services to 15 properties. A 500,000-gallon bolted steel water storage tank will be provided as well as a 35-ft by 40-ft pre-engineered metal pump house. The pump house will include a 100 KW backup generator, a booster pump skid, chlorination equipment, and controls for maintaining tank levels and pressure in the distribution system.

Bids are requested for the following Contract: **CBY Airport Water Extension**

Information and Bidding Documents for the Project can be found at the following designated website:

https://www.yakutatak.us/planning-zoning/page/bids-rfps

Bidding Documents may be downloaded from the designated website. Prospective Bidders are urged to register with the designated website as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with addenda, lists of registered plan holders, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

Pre-bid Conference

A pre-bid conference for the Project will be held on **September 11th** at **1 pm** at **Yakutat High School Auditorium, 429 Forest Highway 10, Yakutat, AK 99689.** Attendance at the pre-bid conference is encouraged but not required.

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

Owner: **City and Borough of Yakutat**
By: **Jon Erikson**
Title: **City and Borough Manager**

Date: **August 12, 2025**
Posting: **Anchorage Daily News, Advertisement August 13th, Anchorage Plans Room and CBY Website.**

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.

2.04 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable using the latest release of Adobe Acrobat Reader. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.04.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents

and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—PRE-BID CONFERENCE

3.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.

3.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 4—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion

Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

4.03 *Site Visit and Testing by Bidders*

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. Bidders visiting the Site are required to arrange their own transportation to the Site.

C. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

D. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

E. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

F. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.04 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

5.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 6—INTERPRETATIONS AND ADDENDA

6.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

6.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. Send an email to Karen.Brady@RESPEC.com, Subject of email should read "CBY Airport Water Extension – Bid Questions"

6.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.

6.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 7—BID SECURITY

7.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

7.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's

damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

7.03 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 8—CONTRACT TIMES

8.01 The dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

8.02 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 9—SUBSTITUTE AND "OR EQUAL" ITEMS

9.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

9.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 10—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

10.01 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening:

A. Water storage tank installer, electrical and controls.

10.02 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

10.03 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable

to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 11—PREPARATION OF BID

11.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

11.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

11.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

11.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

11.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

11.06 A Bid by an individual must show the Bidder's name and official address.

11.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

11.08 All names must be printed in ink below the signatures.

11.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

11.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

11.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

ARTICLE 12—BASIS OF BID

12.01 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

ARTICLE 13—SUBMITTAL OF BID

13.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

13.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid Security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.

13.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 14—MODIFICATION AND WITHDRAWAL OF BID

14.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

14.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

14.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid,

and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 15—OPENING OF BIDS

15.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 16—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

16.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 17—EVALUATION OF BIDS AND AWARD OF CONTRACT

17.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

17.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

17.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

17.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

17.05 *Evaluation of Bids*

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

17.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for

those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

17.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 18—BONDS AND INSURANCE

18.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

18.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 19—SIGNING OF AGREEMENT

19.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

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BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to:

City and Borough of Yakutat

ATTN: City Clerk

clerk@yakutatak.us

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualification Statement with supporting data

ARTICLE 3—BASIS OF BID—UNIT PRICES

3.01 *Unit Price Bids*

A. Bidder will perform the following Work at the indicated unit prices:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
015000-1	Traffic Control	Lump Sum	All Required		$
017300-1	Mobilization	Lump Sum	All Required		$
017300-2	Field Engineering	Lump Sum	All Required		$
024119-1	Selective Demolition	Lump Sum	All Required		$
310000-1	Temporary Erosion and Pollution Control	Lump Sum	All Required		$
311000-1	Clearing and Grubbing	Lump Sum	All Required		$
312000-1	Additional Excavation & Backfill	Cubic Yard	2,000		$
312000-2	Gravel Road Resurfacing	Square Yard	1,940		$
312000-3	Ditch Realignment	Linear Foot	13,550		$
312119-1	Dewatering	Lump Sum	All Required		$
321216-1	3” Hot-Mix Asphalt	Ton	75		$
321216-2	Driveway Asphalt	Square Yard	450		$
329200-1	Topsoil	Square Yard	31,100		$
329200-2	Seeding	Square Yard	31,100		$
330523-1	Horizontal Directional Drilling (8" HDPE SDR17)	Linear Foot	390		$
330523-2	Horizontal Directional Drilling (12" HDPE SDR17)	Linear Foot	300		$
330523-3	Horizontal Directional Drilling (18" HDPE SDR17)	Linear Foot	1,290		$
331100-1	6” HDPE Water Main	Linear Foot	4,600		$
331100-2	10" HDPE Water Main	Linear Foot	13,710		$
331100-3	6" DIP Water Main	Linear Foot	1,160		$
331100-4	10" DIP Water Main	Linear Foot	2,560		$
331100-5	3" Recirculation Line	Linear Foot	16,270		$
331100-6	Fire Hydrants	Each	31		$
331100-7	6” Gate Valves	Each	15		$
331100-8	10" Gate Valves	Each	30		$
331100-9	Water Services	Each	16		$
331100-10	Pump House	Lump Sum	All Required		$
331613-1	500K Gallon Water Storage Tank	Lump Sum	All Required		$
334100-1	18” Corrugated Steel Pipe	Linear Foot	120		$
334100-2	18” Culvert End Section	Each	4		$
334100-3	24” Corrugated Steel Pipe	Linear Foot	110		$
334100-4	24” Culvert End Section	Each	4		$
334100-5	36” Corrugated Steel Pipe	Linear Foot	60		$
334100-6	36” Culvert End Section	Each	2		$
334100-7	60” Corrugated Steel Pipe	Linear Foot	60		$
334100-8	60” Culvert End Section	Each	2		$
334100-9	Culvert Marker Post	Each	12		$
334100-10	18” Corrugated Polyethylene Pipe	Linear Foot	80		$
Total of All Unit Price Bid Items					$

B. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates indicated in the Agreement.

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda: **[Add rows as needed. Bidder is to complete table.]**

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.

2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing

surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

BID BOND (PENAL SUM FORM)

Bidder Name: Address *(principal place of business)*:	**Surety** Name: Address *(principal place of business)*:
Owner Name: **City and Borough of Yakutat (CBY)** Address *(principal place of business)*: **PO Box 160** **Yakutat, AK 99689**	**Bid** Project *(name and location)*: **CBY Airport Water Extension** Bid Due Date: **September 9, 2025**
Bond Penal Sum: Date of Bond:	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	
Bidder *(Full formal name of Bidder)*	Surety *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:
Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.	

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by Owner, or
   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

NOTICE OF AWARD

Date of Issuance:			
Owner:	City and Borough of Yakutat	Owner's Project No.:	
Engineer:	RESPEC	Engineer's Project No.:	I0297.24002
Project:	CBY Airport Water Extension		
Contract Name:	CBY Airport Water Extension		
Bidder:			
Bidder's Address:			

You are notified that Owner has accepted your Bid dated **[date]** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Extending the CBY drinking water system out to the Airport properties which have been affected by PFAS contamination. It will provide 4,580-ft of 6-inch HDPE, 13,710-ft of 10-inch HDPE, 1,160-ft of 6-inch DIP and 2,550-ft of 10-inch DIP. It will provide services to 15 properties. A 500,000-gallon bolted steel water storage tank will be provided as well as a 35-ft by 40-ft pre-engineered metal pump house. The pump house will include a 100 KW backup generator, a booster pump skid, chlorination equipment, and controls for maintaining tank levels and pressure in the distribution system.

The Contract Price of the awarded Contract is $**[Contract Price]**. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

Two unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner **Two** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any)

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **City and Borough of Yakutat**

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between **the City of Borough of Yakutat** ("Owner") and **[name of contracting entity]** ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: Extension of the CBY water system to serve Airport properties in Yakutat, AK.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

This project will extend the CBY drinking water system out to the Airport properties which have been affected by PFAS contamination. It will provide 4,580-ft of 6-inch HDPE, 13,710-ft of 10-inch HDPE, 1,160-ft of 6-inch DIP and 2,550-ft of 10-inch DIP. It will provide services to 15 properties. A 500,000-gallon bolted steel water storage tank will be provided as well as a 35-ft by 40-ft pre-engineered metal pump house. The pump house will include a 100 KW backup generator, a booster pump skid, chlorination equipment, and controls for maintaining tank levels and pressure in the distribution system.

ARTICLE 3—ENGINEER

3.01 The Owner has retained **RESPEC** ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before **October 31, 2027**, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **November 30, 2027.**

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the **15th** day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be based on the number of units completed.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. **90** percent of the value of the Work completed (with the balance being retainage).

1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. **90** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **100** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **200** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. All amounts not paid when due will bear interest at the rate of **10.5** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of **96** sheets with each sheet bearing the following general title: **CBY Airport Water Extension**
8. Addenda (numbers **1** to **[number]**, inclusive).
10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

B. The Contractor acknowledges to and for the benefit of the City and Borough of Yakutat ("Owner") and the EPA and SRF (the "Funding Authority") that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as "Build America, Buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States ("Build America, Buy America Requirements") including iron and steel, manufactured products, and construction materials provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

C. The Contractor acknowledges to and for the benefit of the City and Borough of Yakutat ("Purchaser") and the EPA and the SRF (the "Funding Authority") that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American

Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the Funding Authority that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Purchaser). While the Contractor has no direct contractual privity with the Funding Authority, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on **[indicate date on which Contract becomes effective]** (which is the Effective Date of the Contract).

Owner:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Date: _____
(date signed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

*(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*

Contractor:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Date: _____
(date signed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

*(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

License No.: _____
(where applicable)

State: _____

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NOTICE TO PROCEED

Owner:	City and Borough of Yakutat	Owner's Project No.:	
Engineer:	RESPEC	Engineer's Project No.:	I0297.24002
Contractor:		Contractor's Project No.:	
Project:	CBY Airport Water Extension		
Contract Name:	CBY Airport Water Extension		
Effective Date of Contract:			

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The date by which Substantial Completion must be achieved is **[date for Substantial Completion, from Agreement]**, and the date by which readiness for final payment must be achieved is **[date for readiness, from Agreement]**.

Before starting any Work at the Site, Contractor must comply with the following:

[Note any access limitations, security procedures, or other restrictions]

Owner:	**City and Borough of Yakutat**
By *(signature)*:	
Name *(printed)*:	
Title:	
Date Issued:	

Copy: Engineer

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PERFORMANCE BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **City and Borough of Yakutat**	Description *(name and location)*:
Mailing address *(principal place of business)*:	**CBY Airport Water Extension, Yakutat, Alaska**
PO Box 160	
Yakutat, AK 99689	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

   3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

   3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

   3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

   5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

   5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

   5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

   5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **City and Borough of Yakutat**	Description *(name and location)*: **CBY Airport Water Extension, Yakutat, Alaska**
Mailing address *(principal place of business)*: **PO Box 160 Yakutat, Alaksa 99689**	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

    5.1. Claimants who do not have a direct contract with the Contractor

        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

Contractor's Application for Payment

Owner:	City and Borough of Yakutat	**Owner's Project No.:**	
Engineer:	RESPEC	**Engineer's Project No.:**	I0297.24002
Contractor:		**Contractor's Project No.:**	
Project:	CBY Airport Water Extension		
Contract:	CBY Airport Water Extension		
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

1. Original Contract Price					$ -
2. Net change by Change Orders					$ -
3. Current Contract Price (Line 1 + Line 2)					$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)					$ -
5. Retainage					
a.		X	$ -	Work Completed	$ -
b.		X	$ -	Stored Materials	$ -
c. Total Retainage (Line 5.a + Line 5.b)					$ -
6. Amount eligible to date (Line 4 - Line 5.c)					$ -
7. Less previous payments (Line 6 from prior application)					
8. Amount due this application					$ -
9. Balance to finish, including retainage (Line 3 - Line 4)					$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:
(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;
(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor:

Signature: **Date:**

Recommended by Engineer		**Approved by Owner**	
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	
Approved by Funding Agency			
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: City and Borough of Yakutat
Engineer: RESPEC
Contractor:
Project: CBY Airport Water Extension
Contract: CBY Airport Water Extension

Owner's Project No.:
Engineer's Project No.: I0297.24002
Contractor's Project No.:

Application No.: **Application Period:** From to **Application Date:**

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
					-		-		-		-
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				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: City and Borough of Yakutat
Engineer: RESPEC
Contractor:
Project: CBY Airport Water Extension
Contract: CBY Airport Water Extension

Owner's Project No.:
Engineer's Project No.: I0297.24002
Contractor's Project No.:

Application No.: **Application Period:** From to **Application Date:**

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Change Orders											
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				Change Order Totals	$ -		$ -	$ -	$ -		$ -
Original Contract and Change Orders											
				Project Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Stored Materials Summary

Contractor's Application for Payment

Owner:	City and Borough of Yakutat	**Owner's Project No.:**	
Engineer:	RESPEC	**Engineer's Project No.:**	I0297.24002
Contractor:		**Contractor's Project No.:**	
Project:	CBY Airport Water Extension		
Contract:	CBY Airport Water Extension		

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
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					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

EJCDC C-620 Contractor's Application for Payment
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CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	City and Borough of Yakutat	Owner's Project No.:	
Engineer:	RESPEC	Engineer's Project No.:	I0297.24002
Contractor:		Contractor's Project No.:	
Project:	CBY Airport Water Extension		
Contract Name:	CBY Airport Water Extension		

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

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 Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

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 must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☐ None ☐ As follows:

[List amendments to Owner's Responsibilities]

Amendments to Contractor's Responsibilities: ☐ None ☐ As follows:

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

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 Documents.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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NOTICE OF ACCEPTABILITY OF WORK

Owner:	City and Borough of Yakutat	Owner's Project No.:	
Engineer:	RESPEC	Engineer's Project No.:	I0297.24002
Contractor:		Contractor's Project No.:	
Project:	CBY Airport Water Extension		
Contract Name:	CBY Airport Water Extension		
Notice Date:		Effective Date of the Construction Contract:	

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated **[date of professional services agreement]** ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. Constituent of Concern—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
    a. to supervise, direct, or control the Work;
    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
    a. the Work is defective, requiring correction or replacement;
    b. the Contract Price has been reduced by Change Orders;
    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must be accompanied (except as previously delivered) by:
    a. all documentation called for in the Contract Documents;
    b. consent of the surety, if any, to final payment;
    c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;

2. correct such defective Work;

3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

No Supplementary Conditions in this Article.

ARTICLE 2 - PRELIMINARY MATTERS

2.02 *Copies of Documents*

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

A. Owner shall furnish to Contractor **1** printed copy of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No Supplementary Conditions in this Article.

ARTICLE 4 - COMMENCEMENT AND PROGRESS OF THE WORK

No Supplementary Conditions in this Article.

ARTICLE 5 - SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 Availability of Lands

Delete Paragraph 5.01.B in its entirety and insert the following in its place:

B. Rights of Way and Easements are shown on Drawings.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Engineering Report, Yakutat Airport Water Line Extension	April 2025	Bore Logs 1-29 in Appendix A
Environmental Summary Report, Yakutat Water Line Extension	May 2025	Bore Logs 1-29 in Appendix A, Sample Analytical Results in Appendix C-E
Revised Draft Final- Contaminated Materials Management Plan	August 2025	Contaminated Sites, Exhibit 4-1

ARTICLE 6 - BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2018 edition).

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2018 edition).

6.03 *Contractor's Insurance*

SC-6.03 Delete Paragraph 6.03 in its entirety and insert the following in its place:

6.03 *Contractor's Insurance*

A. Prior to starting work, the Contractor shall purchase and maintain at its expense commercial general liability and other insurance as set forth below from a responsible insurer authorized to do business in the state where the Project is located and having an A.M. Best rating of at least A VII. Contractor shall furnish satisfactory evidence to the Owner that the Contractor has complied with the requirements in the form of an insurance certificates and Owner reserves the right, upon written request, to receive and review all Contractor insurance policies and endorsements in effect during the duration of this contract and for any duration thereafter for which coverage is required as set forth below.

B. All policies shall be written on an occurrence basis, shall (except Workers Compensation) include the Owner, Architect, Construction Manager, General Contractor, and the architects, directors, officers, representatives, agents, and employees of such parties as additional insureds and Contractors' policies shall be primary over any insurance or self-insurance program of any such party. Contractor shall ensure that its subcontractors, at a minimum carry insurance equivalent to the coverages set forth below. The insurance required shall be written for not less than any limits of liability stated in this Contract, in the Contract Documents or as required by law, whichever is greater. Contractor's liability is not limited to the minimum amounts of insurance coverage required. The Contractor is solely responsible for determining whether additional coverage or greater limits are required to protect its interests from hazards or claims in excess of the specified minimum insurance. Where special

or unusual hazards peculiar to this project are foreseeable, the Contractor shall take such steps as are necessary to insure it against such hazards.

C. *Property Insurance:* The Contractor for construction contracts shall submit to the Owner evidence of All Risk Builder's Risk Insurance for all physical loss (100% completed value basis) upon the entire work naming the Owner, the Contractor and the subcontractors as additional insured parties and as their interests may appear to the full contract sum thereof, until the project is substantially completed by the Contractor and accepted by the Owner.

D. *Commercial General Liability:* Contractor will maintain commercial general liability insurance covering all operations by or on behalf of Contractor on an occurrence basis against claims for personal injury, bodily injury, death and property damage (including loss of use). Such insurance will have these minimum limits and coverage:

1. Minimum Limits:
    a. $1,000,000 each occurrence
    b. $1,000,000 personal & adv injury
    c. $2,000,000 general aggregate
    d. $2,000,000 products and completed operations aggregate
2. Coverages
    a. The policy shall be written on ISO form CG 00 01 12 07 or equivalent.
    b. Contractual Liability Coverage shall be as provided in CG 00 01 12 07. The policy shall be free from any endorsement or language limiting contractual liability coverage beyond the limitations of CG 00 01 12 07.
    c. The policy shall be free from ISO endorsements CG 22 94, CG 22 95 or any equivalent endorsement or language.
    d. The policy shall provide for severability of interests.
    e. The policy shall be free from ISO endorsement CG 21 42 or CG 21 43 or any similar endorsement limiting or excluding coverage for Explosion, Collapse and Underground exposures.
    f. The general aggregate shall apply on a "per project" basis.
    g. The policy shall provide for a specific waiver of subrogation in favor of the additional insured parties.
    h. The policy shall contain additional insured endorsement CG 20 10 04 13 and CG 20 37 04 13 or equivalent as approved by Owner.
    i. The policy shall be written to provide coverage on a primary and non-contributory basis.

E. *Automobile Liability:* Contractor will maintain business auto liability insurance covering liability arising out of any auto (including owned, hired, and non-owned autos).

3. Minimum Limits: $1,000,000 combined single limit each accident

4. Coverages:
    a. Additional insured endorsement
    b. Specific waiver of subrogation
    c. Contractual liability

F. *Workers' Compensation:* Contractor will maintain workers' compensation and employer's liability insurance.

5. Minimum Limits
    a. Workers' compensation – statutory limit
    b. Employer's liability:
        j. $1,000,000 bodily injury for each accident
        k. $1,000,000 bodily injury by disease for each employee
        l. $1,000,000 bodily injury disease aggregate

6. Coverages:
    a. The policy shall provide for a specific waiver of subrogation in favor of the parties required to be named additional insured under the Contractor's General Liability policy.

G. *Umbrella/Excess Liability:* Contractors with contracts less than $2 million who meet the minimum coverages for Commercial General Liability; Automobile Liability; and Workers Compensation. Subcontractors as stated do not need Umbrella/Excess Liability coverage. Contractors with contracts in excess of $2 million will maintain umbrella/excess liability insurance on an occurrence basis in excess of the underlying insurance described above which is at least as broad as each and every one of the underlying polices. The amounts of insurance required above may be satisfied by Contractor purchasing coverage for the limits specified or by any combination of underlying and umbrella limits, so long as the total amount of insurance is not less than the limits specified above when added to the limit specified in this paragraph.

7. Minimum limits: $10,000,000 combined single limit and aggregate limit.

8. Coverages:
    a. Coverage must be provided for those parties required to be named additional insured on the General Liability policy on a follow-form basis.
    b. Pay on behalf of wording
    c. Concurrency of effective dates with primary
    d. Blanket contractual liability
    e. Punitive damages coverage (where not prohibited by law)
    f. Aggregates: apply where applicable in primary
    g. Drop down feature

H. *Additional Coverages - required only if applicable*

9. *Pollution Liability:* Contractor will purchase pollution liability insurance coverage with all coverage retroactive to the earlier of the date of this Contract and the commencement of Contractor's services in relation to the Project as follows: (If Applicable)

h. Minimum Limits: $2,000,000 each occurrence/$4,000,000 aggregate

i. Coverages:

1) Contractual Liability

m. Personal Injury

n. Bodily Injury

o. Property Damage

p. Contractor named Loss Payee

q. Primary and noncontributory coverage

10. *Professional Liability:* When the Contractor's work includes the provision of professional services, Contractor will purchase professional liability insurance coverage with all coverage retroactive to the earlier of the date of this Contract and the commencement of the Contractor's services in relation to the Project as follows: (If Applicable)

Minimum Limits: $2,000,000 each occurrence/$4,000,000 aggregate

j. Coverages:

1) Contractual Liability

r. Personal Injury

s. Bodily Injury

t. Property Damage

u. Contractor named Loss Payee

v. Primary and noncontributory coverage

I. *Waivers of Subrogation:* The Contractor waives all rights against the Owner and any of its subcontractors, sub-subcontractors, agents, employees, the Construction Manager, the Architect, Owner's Engineer, Bank's Engineer, Construction Agent, Financing Parties and all tiers of contractors or consultants engaged by them; for recovery under subrogation or otherwise to the extent covered by insurance required under this contract or other insurance applicable to the Work, except such rights as the Contractor may have to proceeds of any insurance held by the Owner as fiduciary, if any. The Contractor shall require of the Subcontractor's, Sub-subcontractors, agents and employees, by appropriate agreements, written where legally required for validity, similar waivers in favor of the parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity

had an insurable interest in property damaged. The above waiver may exclude subrogation due to Engineer's and its subconsultants' professional errors or omissions.

J. *Duration of Coverage:* All required coverages will be maintained without interruption during the entire term of this Subcontract plus an additional two (2) years in products and completed operation coverage following final acceptance of the Project by the Owner and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work.

K. *Notice of Cancellation:* Required insurance policies shall contain an endorsement requiring the insurance carrier to provide 30 days advance written notice to the Owner prior to any change in or cancellation of any policy required herein. Should any coverage expire prior to completion of Work, proof of renewal of said policy shall be provided to Owner at least Thirty (30) days prior to expiration date of the policy.

ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.A:

1. Contractor shall perform the Work in accordance with the State of Alaska Department of Labor, Division of Occupational Health and Safety, Construction Code (latest version).

7.04 Services, Materials and Equipment

SC-7.04 Add the following new subparagraphs immediately after Paragraph 7.04.C:

D. American Iron and Steel Requirements

1. The Contractor acknowledges to and for the benefit of the City and Borough of Yakutat and the State of Alaska that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement.

2. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser).

3. While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

E. Build America, Buy America Act Requirements

1. The Contractor acknowledges to and for the benefit of the City and Borough of Yakutat and the EPA that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as "Build America, Buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States ("Build America, Buy America Requirements") including iron and steel, manufactured products, and construction materials provided by the Contactor pursuant to this Agreement.

2. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority.

3. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner).

4. If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

7.08 Patent Fees and Royalites

SC 7.08 Delete Paragraph 7.08.B in its entirety.

ARTICLE 8 - OTHER WORK AT THE SITE

No Supplementary Conditions in this Article.

ARTICLE 10 - ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

   a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

   b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

7. *Completion*

   a. Participate in Engineer's visits regarding Substantial Completion.

b. Assist in the preparation of a punch list of items to be completed or corrected.

c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11 - CHANGES TO THE CONTRACT

No Supplementary Conditions in this Article.

ARTICLE 12 - CLAIMS

No Supplementary Conditions in this Article.

ARTICLE 13 - COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 *Cost of the Work*

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the extended price of a particular item of Unit Price Work amounts to **5** percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than **25** percent from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

No Supplementary Conditions in this Article.

ARTICLE 15 - PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

ARTICLE 16 - SUSPENSION OF WORK AND TERMINATION

No Supplementary Conditions in this Article.

ARTICLE 17- FINAL RESOLUTIONS OF DISPUTES

17.02 *Arbitration*

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

17.02 *Arbitration*

A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of $100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in

question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.

D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.

E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.

F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.

G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer’s consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;

2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;

3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and

4. the consolidation or joinder is in compliance with the arbitration administrator’s procedural rules.

H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the

exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

ARTICLE 18 - MISCELLANEOUS

No Supplementary Conditions in this Article.

WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner:	City and Borough of Yakutat	Owner's Project No.:	
Engineer:	RESPEC	Engineer's Project No.:	I0297.24002
Contractor:		Contractor's Project No.:	
Project:	CBY Airport Water Extension		
Contract Name:	CBY Airport Water Extension		
Date Issued:		Effective Date of Work Change Directive:	

Contractor is directed to proceed promptly with the following change(s):

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ _____ **[increase] [decrease] [not yet estimated]**.

Contract Time: _____ days **[increase] [decrease] [not yet estimated]**.

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:		
Title:		
Date:		

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CHANGE ORDER NO.: [Number of Change Order]

Owner:	City and Borough of Yakutat	Owner's Project No.:	
Engineer:	RESPEC	Engineer's Project No.:	I0297.24002
Contractor:		Contractor's Project No.:	
Project:	CBY Airport Water Extension		
Contract Name:	CBY Airport Water Extension		
Date Issued:		Effective Date of Change Order:	

The Contract is modified as follows upon execution of this Change Order:

Description:

[Description of the change]

Attachments:

[List documents related to the change]

Change in Contract Price	**Change in Contract Times** [State Contract Times as either a specific date or a number of days]
Original Contract Price: $ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. **[Number of previous Change Order]**: $ _____	**[Increase] [Decrease]** from previously approved Change Orders No.1 to No. **[Number of previous Change Order]**: Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: $ _____	**[Increase] [Decrease]** this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: $ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

	Recommended by Engineer (if required)	Accepted by Contractor
By:	_____	_____
Title:	_____	_____
Date:	_____	_____
	Authorized by Owner	Approved by Funding Agency (if applicable)
By:	_____	_____
Title:	_____	_____
Date:	_____	_____

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FIELD ORDER NO.: [Number of Field Order]

Owner:	City and Borough of Yakutat	Owner's Project No.:	
Engineer:	RESPEC	Engineer's Project No.:	I0297.24002
Contractor:		Contractor's Project No.:	
Project:	CBY Airport Water Extension		
Contract Name:	CBY Airport Water Extension		
Date Issued:		Effective Date of Field Order:	

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____

Title: _____

Date: _____

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SPECIAL CONDITIONS

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ATTACHMENTS

SPC -AK20250001 Davis-Bacon Wage Rates for Alaska Heavy Construction
Pamphlet No. 600 Issue 50 Minimum Rates of Pay for Laborers and Mechanics
Debarment Certification Form (EPA Form 5700-49)
SRF EEO Acknowledgment Form
Disadvantaged Business Enterprise Compliance Statement
Disadvantaged Business Enterprise (DBE) Program Good Faith Effort and Participation Form

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SPECIAL CONDITIONS

SPC-1 CONFLICT WITH GENERAL CONDITIONS AND SUPPLEMENTARY GENERAL CONDITIONS

The Special Conditions supplement the General Conditions and the Supplementary General Conditions. Where conflicts exist between the Special Conditions and the General or Supplementary Conditions, the Special Conditions prevail.

SPC-2 CHARACTER OF WORKMEN, EQUIPMENT AND METHODS

A. All workers shall have sufficient skill and experience to properly perform the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work, and in the operation of the equipment required, to perform all work properly and satisfactorily.

   1. Any person employed by the Contractor or by any subcontractor who, in the opinion of the Owner, does not perform his work in a proper and skillful manner or is intemperate or disorderly, shall, at the written request of the Owner, be removed forthwith by the Contractor or Subcontractor employing such person, and shall not be employed again in any portion of the project without approval from the Owner.

   2. Should the Contractor fail to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for proper execution of the work, the Owner may suspend work by written notice until such orders are complied with.

B. All equipment shall be appropriately sized and in such mechanical condition as to meet the requirements of the work and to produce a satisfactory quality of work.

C. When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that he demonstrates to the satisfaction of the Owner will accomplish the contract work in conformity with the requirements of the contract, except as provided above.

SPC-3 DRUG ABUSE POLICY

The Contractor shall comply with requirements for testing for the presence of alcohol and controlled substances in accordance with any federal, state, or local laws, as applicable.

SPC-4 LABORERS' AND MECHANICS' MINIMUM RATES OF PAY

The Contractor and subcontractors shall comply with Davis-Bacon Act, as amended (40 U.S.C. 3141-3148) and as supplemented by Department of Labor regulations (29 CFR Part 5. "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction", the Contract Work Hours and Safety Standards Act (40 U.S.C 3701-3708) and AS 36.05.010.

Since this project is funded in part by EPA, it is subject to:

- Contract Provisions for Davis-Bacon and Related Acts located here: https://www.epa.gov/grants/contract-provisions-davis-bacon-and-related-acts
- DBRA Requirements for EPA Subrecipients located here: https://www.epa.gov/grants/dbra-requirements-epa-subrecipients

Contractors are required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. The Contractor and all subcontractors shall pay the higher of the appropriate wage rates published by the Alaska Department of Labor and the U.S. Department of Labor, for each individual job classification. In addition, contractors must be required to pay wages not less than once a week and submit certified payroll records per the DOL form WH-347. A copy of the latest Davis-Bacon Wage Rates for Alaska, AK20250001 and Minimum Rates of Pay for Labors and Mechanics, Pamphlet No. 600 are attached.

Contractors shall comply with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States").

SPC-5 LAND CLEARING TIMING

Clearing and grubbing shall be completed prior to May 1, to the fullest extent possible, in order to comply with U.S. Fish and Wildlife Service timing recommendations for land disturbance and vegetation clearing.

SPC-6 WORK WITHIN STATE OF ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES (ADOT&PF) RIGHTS OF WAY

The Owner has submitted utility permit applications to the ADOT&PF for all work within the ADOT&PF right of way. The Contractor will be required to comply with the conditions of this permit when working within ADOT&PF right of way, or the construction documents, whichever is more stringent.

Final signed permits are attached. Any permit requirements not conveyed during the bidding period will be included in the construction documents by change order.

Any work within ADOT&PF right of way must be covered by a lane closure permit, regardless of proximity to the roadway.

SPC-7 ADEC APPROVAL TO CONSTRUCT

The Engineer has received ADEC Drinking Water for Approval to Construct the CBY Airport Water Extension.

SPC-8 NONDISCRIMINATION

A. By signing this agreement or accepting funds under this agreement, the recipient assures that it will not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in termination of this contract or other legally available remedies.

SPC-9 ENVIRONMENTAL STANDARDS

A. By signing this agreement or accepting funds under this agreement, the recipient assures that it will:

1. Comply with applicable provisions of the Clean Air Act (42 U.S.C. 7401, et. seq.) and Clean Water Act (33 U.S.C. 1251, et. seq.), as implemented by Executive Order 11738 [3 CFR, 1971- 1975 Comp., p. 799] and Environmental Protection Agency (EPA) rules at Subpart J of 40 CFR part 32

SPC-10 OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit arising from it, in accordance with 41 U.S.C. 22.

SPC-11 CONTRACTING WITH SMALL AND MINORITY BUSINESSES, WOMEN'S BUSINESS ENTERPRISES, AND LABOR SURPLUS AREA FIRMS

A. The non-Federal entity must take all necessary affirmative steps to assure that small and minority businesses, women's business enterprises, and labor surplus area firms are used when possible.

B. Affirmative steps must include:

1. Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

2. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;

3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;

4. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;

5. Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and

6. Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (1) through (5) of this section.

C. Contractor must complete and sign the Disadvantage Business Enterprise Compliance Statement and the Disadvantage Business Enterprise (DBE) Program Good Faith Effort Participation Form.

SPC-12 DEBARMENT AND SUSPENSION

A. (Executive Orders 12549 and 12689); A contract award (see 2 CFR 180.220) shall not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension."

SPC-13 BYRD ANTI-LOBBYING AMENDMENT

A. Contractors that apply or bid for an award exceeding $100,000 must file the required certification (31 U.S.C. 1352).

SPC-14 SIGNAGE

A. Contractor is required to place a physical sign displaying the EPA logo at the construction site for this project in an easily visible location that can be directly linked to the work taking place. The sign must be maintained in good condition throughout the construction period. In cases where the construction site covers a large area (e.g., lead service line replacement or septic tank

repair/replacement projects), a sign should be placed in an easily visible location near where the work is being performed (e.g., entrance to the neighborhood, along a main road through town, etc.).

B. Procuring Signs: Consistent with section 6002 of RCRA, 42 U.S.C. 6962, and 2 CFR 200.323, recipients are encouraged to use recycled or recovered materials when procuring signs.
C. EPA Logo: The recipient will ensure that signage displays the EPA logo. The EPA logo must not be displayed in a manner that implies that EPA itself is conducting the project. Instead, the EPA logo must be accompanied with a statement indicating that the recipient received financial assistance from EPA for the project.
D. The recipient will ensure compliance with the sign specifications provided by the EPA Office of Public Affairs (OPA) available at: https://www.epa.gov/grants/epa-logo-seal-specifications-signage-produced- epa-assistance-agreement-recipients. As provided in the sign specifications from OPA, the EPA logo is the preferred identifier for assistance agreement projects and use of the EPA seal requires prior approval from the EPA. To obtain the appropriate EPA logo or seal graphic file, the recipient should send a request directly to **Londa Scott-Forte (202-564-1504)** and **Jini Ryan (202-564-1075).** Please explain in the message that the EPA logo is to be used on signage at a construction site funded with EPA assistance and copy the EPA Project Officer on the message.

SPC-15 EQUAL EMPLYMENT OPPORTUNITY

By signing the agreement or accepting funds under the agreement, the recipient assures that it will comply with the requirements of 41 CFR 60-1.4(b).

SPC-16 GENERAL PERMIT FOR BALD EAGLE DISTURBANCE

The Construction Contractor is required to obtain a general permit for bald eagle disturbance via the automated online system and provide proof to the CBY prior to beginning ground disturbing activities. The following link. https://www.fws.gov/program/eagle-management/eagle-incidental-disturbance-and-nest-take-permits

"General Decision Number: AK20250001 07/11/2025

Superseded General Decision Number: AK20240001

State: Alaska

Construction Types: Building and Heavy

Counties: Alaska Statewide.

BUILDING AND HEAVY CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025

1	01/31/2025
2	03/14/2025
3	04/18/2025
4	04/25/2025
5	05/16/2025
6	07/11/2025

ASBE0007-006 02/27/2023

	Rates	Fringes
Asbestos Workers/Insulator (includes application of all insulating materials protective coverings, coatings and finishings to all types of mechanical systems)	$ 41.35	16.46
HAZARDOUS MATERIAL HANDLER (includes preparation, wetting, stripping, removal scrapping, vacuming, bagging, and disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems)	$ 37.38	19.55

BOIL0502-002 01/01/2025

	Rates	Fringes
BOILERMAKER	$ 58.33	28.79

BRAK0001-002 07/01/2024

	Rates	Fringes
Bricklayer, Blocklayer, Stonemason, Marble Mason, Tile Setter, Terrazzo Worker	$ 52.77	12.36
Tile & Terrazzo Finisher	$ 40.91	12.48

CARP1281-001 04/01/2025

	Rates	Fringes
CARPENTER		
Including Lather and Drywall Hanging	$ 50.79	26.42

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* CARP1281-002 06/01/2025

	Rates	Fringes
MILLWRIGHT	$ 56.44	25.87

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* CARP2520-003 04/01/2025

	Rates	Fringes
Diver		
Stand-by	$ 61.42	25.34
Tender	$ 53.03	25.34
Working	$ 92.83	26.42
Piledriver		

Piledriver; Skiff Operator and Rigger	$ 48.72	26.42
Sheet Stabber	$ 48.72	26.42
Welder	$ 54.28	26.42

DEPTH PAY PREMIUM FOR DIVERS BELOW WATER SURFACE:

50-100 feet	$1.00 per foot
101 feet and deeper	$2.00 per foot

ENCLOSURE PAY PREMIUM WITH NO VERTICAL ASCENT:

5-50 FEET	$1.00 PER FOOT/DAY
51-100 FEET	$2.00 PER FOOT/DAY
101 FEET AND ABOVE	$3.00 PER FOOT/DAY

SATURATION DIVING:
The standby rate applies until saturation starts. The saturation diving rate applies when divers are under pressure continuously until work task and decompression are complete. the diver rate shall be paid for all saturation hours.

WORK IN COMBINATION OF CLASSIFICATIONS:
Employees working in any combination of classifications within the diving crew (except dive supervisor) in a shift are paid in the classification with the highest rate for that shift.

ELEC1547-004 04/01/2025

	Rates	Fringes
CABLE SPLICER	$ 53.44	3%+28.67
ELECTRICIAN	$ 53.44	3%+28.67

ELEC1547-005 04/01/2025

Line Construction

	Rates	Fringes
CABLE SPLICER	$ 74.34	3%+33.47
Linemen (Including Equipment Operators, Technician)	$ 72.59	3%+33.47
Powderman	$ 70.59	3%+33.47
TREE TRIMMER	$ 42.23	3%+28.83

ELEV0019-002 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC	$ 71.44	38.435+a+b

FOOTNOTE:
a. Employer contributes 8% of the basic hourly rate for over 5 year's service and 6% of the basic hourly rate for 6 months to 5 years' of service as vacation paid credit.
b. Eight paid holidays:
New Year's Day; Memorial Day; Independence Day; Labor Day; Veteran's Day; Thanksgiving Day; Friday after Thanksgiving, and Christmas Day

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ENGI0302-002 01/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 53.23	29.50
GROUP 1A	$ 55.33	29.50
GROUP 2	$ 52.32	29.50
GROUP 3	$ 51.46	29.50
GROUP 4	$ 44.06	29.50
TUNNEL WORK		
GROUP 1	$ 58.55	29.50
GROUP 1A	$ 60.86	29.50
GROUP 2	$ 57.55	29.50
GROUP 3	$ 56.60	29.50
GROUP 4	$ 48.47	29.50

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Asphalt Roller: Breakdown, Intermediate, and Finish; Back Filler; Barrier Machine (Zipper); Beltcrete with power pack and similar conveyors; Bending Machine; Boat Coxwains; Bulldozers; Cableways, Highlines and Cablecars; Cleaning Machine; Coating Machine; Concrete Hydro Blaster; Cranes-45 tons and under or 150 foot boom and under (including jib and attachments): (a) Hydralifts or Transporters, all track or truck type,(b) Derricks; Crushers; Deck Winches-Double Drum; Ditching or Trenching Machine (16 inch or over); Drilling Machines, core, cable, rotary and exploration; Finishing Machine Operator, Concrete Paving, Laser Screed, Sidewalk, Curb and Gutter Machine; Helicopters; Hover Craft, Flex Craft, Loadmaster, Air Cushion, All Terrain Vehicle, Rollagon, Bargecable, Nodwell, and Snow Cat; Hydro Ax: Feller Buncher and similar; Loaders (2 1/2 yards through 5 yards, including all attachments): Forklifts with telescopic boom and swing attachment, Overhead and front end, 2 1/2 yards through 5 yards, Loaders with forks or pipe clamps; Loaders, elevating belt type, Euclid and similar types; Mechanics, Bodyman; Micro Tunneling Machine; Mixers: Mobile type w/hoist combination; Motor Patrol Grader; Mucking Machines: Mole, Tunnel Drill, Horizontal/Directional Drill Operator, and/or Shield; Operator on Dredges; Piledriver Engineers, L. B. Foster, Puller or similar Paving Breaker; Power Plant, Turbine Operator, 200 k.w. and over (power plants or combination of power units over 300 k.w.); Scrapers-through 40 yards; Service Oiler/Service Engineer; Sidebooms-under 45 tons; Shot Blast Machine; Shovels, Backhoes, Excavators with all attachments, and Gradealls (3 yards and under), Spreaders, Blaw Knox, Cedarapids, Barber Greene, Slurry Machine; Sub-grader (Gurries, Reclaimer, and similar types); Tack tractor; Truck mounted Concrete Pumps, Conveyor, Creter; Water Kote Machine; Unlicensed off road hauler

GROUP 1A: Camera/Tool/Video Operator (Slipline), Cranes-over 45 tons or 150 foot (including jib and attachments): (a) Clamshells and Draglines (over 3 yards), (b) Tower cranes; Licensed Water/Waste Water Treatment Operator; Loaders over 5 yds.; Certified Welder, Electrical Mechanic, Camp Maintenance Engineer, Mechanic (over 10,000 hours); Motor Patrol Grader, Dozer, Grade Tractor, Roto-mill/Profiler (finish: when finishing to final grade and/or to hubs, or for asphalt); Power Plants: 1000 k.w. and over; Quad; Screed; Shovels, Backhoes, Excavators with all attachments (over 3 yards), Sidebooms over 45 tons;

Slip Form Paver, C.M.I. and similar types; Scrapers over 40 yards;

GROUP 2: Boiler-fireman; Cement Hog and Concrete Pump Operator; Conveyors (except as listed in group 1); Hoist on steel erection; Towermobiles and Air Tuggers; Horizontal/Directional Drill Locator;Licensed Grade Technician; Loaders, (i.e., Elevating Grader and Material Transfer Vehicle); Locomotives: rod and geared engines; Mixers; Screening, Washing Plant; Sideboom (cradling rock drill regardless of size); Skidder; Trencing Machine under 16 inches; Waste/ Waste Water Treatment Operator.

GROUP 3: ""A"" Frame Trucks, Deck Winches: single power drum; Bombardier (tack or tow rig); Boring Machine; Brooms-power; Bump Cutter; Compressor; Farm tractor; Forklift, industrial type; Gin Truck or Winch Truck with poles when used for hoisting; Grade Checker and Stake Hopper; Hoist, Air Tuggers, Elevators; Loaders: (a) Elevating-Athey, Barber Green and similar types (b) Forklifts or Lumber Carrier (on construction job site) (c) Forklifts with Tower (d) Overhead and Front-end, under 2 1/2 yds. Locomotives:Dinkey (air, steam, gas and electric) Speeders; Mechanics (light duty); Oil, Blower Distribution; Post Hole Diggers, mechanical; Pot Fireman (power agitated); Power Plant, Turbine Operator, under 200 k.w.; Pumps-water; Roller-other than Plantmix; Saws, concrete; Skid Steer with all attachments; Straightening Machine; Tow Tractor

GROUP 4: Rig Oiler/Crane Assistant Engineer;Parts and Equipment Coordinator; Swamper (on trenching machines or shovel type equipment); Spotter; Steam Cleaner; Drill Helper.

FOOTNOTE: Groups 1-4 receive 10% premium while performing tunnel or underground work. Rig Oiler/Crane Assistant Engineer shall be required on cranes over 85 tons or over 100 feet of boom.

IRON0751-003 07/01/2024

	Rates	Fringes
IRONWORKER		
BENDER OPERATOR	$ 44.99	38.98
BRIDGE, STRUCTURAL, ORNAMENTAL, REINFORCING MACHINERY MOVER, RIGGER, SHEETER, STAGE RIGGER, BENDER OPERATOR	$ 44.99	38.98
FENCE, BARRIER INSTALLER	$ 41.49	38.98
GUARDRAIL INSTALLERS	$ 42.49	38.98
GUARDRAIL LAYOUT MAN	$ 42.23	38.98
HELICOPTER, TOWER	$ 45.99	38.98

LABO0341-001 04/01/2025

	Rates	Fringes
LABORER (South of the 63rd Parallel & West of Longitude 138 Degrees)		
GROUP 1	$ 40.25	34.26
GROUP 2	$ 41.25	34.26

GROUP 3	$ 42.15	34.26
GROUP 3A	$ 46.53	34.26
GROUP 3B	$ 54.01	28.81
GROUP 4	$ 29.82	34.26
TUNNELS, SHAFTS, AND RAISES		
GROUP 1	$ 44.28	34.26
GROUP 2	$ 45.38	34.26
GROUP 3	$ 46.37	34.26
GROUP 3A	$ 51.18	34.26
GROUP 3B	$ 59.41	28.81

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer(curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Laying of Decorative Block (retaining walls, flowered decorative block 4 feet and below); Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump Man or Mixer Man; Railroad Track Laborer; Sandblast, Pot Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk, Utilidor Laborer and Conduit Installer; Watchman (construction projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Culvert Pipe Laborer; Cured in place Pipelayer; Environmental Laborer (marine work, oil spill skimmer operator, small boat operator); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds);Laying of Decorative Block (retaining walls, flowered decorative block above 4 feet); Mason Tender and Mud Mixer (sewer work); Pilot Car; Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Alarm Installer; Bit Grinder; Guardrail Machine Operator; High Rigger and tree topper; High Scaler; Multiplate; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers

GROUP 3B: Grade checker (setting or transfering of grade marks, line and grade)

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Nozzleman, Pumpcrete or Shotcrete.

GROUP 3: Miner; Retimberman

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers.

GROUP 3B: Grade checker (setting or transfering of grade marks, line and grade)

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

LABO0942-001 04/01/2025

	Rates	Fringes
Laborers: North of the 63rd Parallel & East of Longitude 138 Degrees		
GROUP 1	$ 40.25	34.26
GROUP 2	$ 41.25	34.26
GROUP 3	$ 42.15	34.26
GROUP 3A	$ 46.53	34.26
GROUP 3B	$ 54.01	28.81
GROUP 4	$ 29.82	34.26
TUNNELS, SHAFTS, AND RAISES		
GROUP 1	$ 44.28	34.26
GROUP 2	$ 45.38	34.26
GROUP 3	$ 46.37	34.26
GROUP 3A	$ 51.18	34.26
GROUP 3B	$ 59.41	28.81

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer(curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Laying of Decorative Block (retaining walls, flowered decorative block 4 feet and below); Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump Man or Mixer Man; Railroad Track Laborer; Sandblast, Pot Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk, Utilidor Laborer and Conduit Installer; Watchman (construction

projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Culvert Pipe Laborer; Cured in place Pipelayer; Environmental Laborer (marine work, oil spill skimmer operator, small boat operator); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds);Laying of Decorative Block (retaining walls, flowered decorative block above 4 feet); Mason Tender and Mud Mixer (sewer work); Pilot Car; Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Alarm Installer; Bit Grinder; Guardrail Machine Operator; High Rigger and tree topper; High Scaler; Multiplate; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers

GROUP 3B: Grade checker (setting or transfering of grade marks, line and grade)

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Nozzleman, Pumpcrete or Shotcrete.

GROUP 3: Miner; Retimberman

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers.

GROUP 3B: Grade checker (setting or transfering of grade marks, line and grade)

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

PAIN1959-001 07/01/2024

NORTH OF THE 63RD PARALLEL

	Rates	Fringes
PAINTER		
BRUSH/ROLLER PAINT OR WALL		

COVERER.....$ 40.33 26.17
TAPING, TEXTURING,
STRUCTURAL PAINTING,
SANDBLASTING, POT TENDER,
FINISH METAL, SPRAY,
BUFFER OPERATOR, RADON
MITIGATION, LEAD BASED
PAINT ABATEMENT, HAZARDOUS
MATERIAL HANDLER.....$ 40.85 26.17

PAIN1959-002 07/01/2024

SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
PAINTER		
General Painter	$ 35.97	28.52
Industrial Painter	$ 37.32	28.52
Taper / Paper & Vinyl Hanger	$ 37.22	28.52

PAIN1959-003 07/01/2024

NORTH OF THE 63RD PARALLEL

	Rates	Fringes
GLAZIER	$ 44.54	29.68

PAIN1959-004 07/01/2023

	Rates	Fringes
FLOOR LAYER: Carpet	$ 39.86	15.87

PAIN1959-006 07/01/2024

SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
GLAZIER	$ 45.20	28.32

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* PLAS0528-006 04/01/2025

	Rates	Fringes
PLASTERER		
North of the 63rd parallel	$ 49.28	22.28
South of the 63rd parallel	$ 49.28	22.28

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* PLAS0528-007 04/01/2025

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER		
North of the 63rd parallel	$ 49.28	22.28
South of the 63rd parallel	$ 49.28	22.28

PLUM0262-002 01/01/2023

East of the 141st Meridian

	Rates	Fringes

Plumber; Steamfitter.....$ 41.50 27.62

PLUM0367-002 04/01/2025

South of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter.....	$ 47.50	32.45

PLUM0375-002 07/01/2024

North of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter.....	$ 51.66	32.90

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* PLUM0669-002 04/01/2025

	Rates	Fringes
SPRINKLER FITTER.....	$ 60.67	31.39

ROOF0189-006 04/01/2024

	Rates	Fringes
ROOFER.....	$ 49.62	18.53

SHEE0023-003 07/01/2024

South of the 63rd Parallel

	Rates	Fringes
SHEET METAL WORKER.....	$ 48.75	30.14

SHEE0023-004 07/01/2024

North of the 63rd Parallel

	Rates	Fringes
SHEET METAL WORKER.....	$ 54.00	30.52

TEAM0959-003 01/01/2025

	Rates	Fringes
TRUCK DRIVER		
GROUP 1.....	$ 51.58	26.43
GROUP 1A.....	$ 53.05	26.43
GROUP 2.....	$ 50.12	26.43
GROUP 3.....	$ 49.17	26.43
GROUP 4.....	$ 48.50	26.43
GROUP 5.....	$ 47.62	26.43

GROUP 1: Semi with Double Box Mixer; Dump Trucks (including rockbuggy and trucks with pups) over 40 yards up to and including 60 yards; Deltas, Commanders, Rollogans and similar equipment when pulling sleds, trailers or similar equipment; Boat Coxswain; Lowboys including attached trailers and jeeps, up to and including 12 axles; Ready-mix

over 12 yards up to and including 15 yards); Water Wagon (250 Bbls and above); Tireman, Heavy Duty/Fueler

GROUP 1A: Dump Trucks (including Rockbuggy and Trucks with pups) over 60 yards up to and including 100 yards; Jeeps (driver under load)

GROUP 2: Turn-O-Wagon or DW-10 not self-loading; All Deltas, Commanders, Rollogans, and similar equipment; Mechanics; Dump Trucks (including Rockbuggy and Trucks with pups) over 20 yards up to and including 40 yards; Lowboys including attached trailers and jeeps up to and including 8 axles; Super vac truck/cacasco truck/heat stress truck; Ready-mix over 7 yards up to and including 12 yards; Partsman; Stringing Truck

GROUP 3: Dump Trucks (including Rockbuggy and Trucks with pups) over 10 yards up to and including 20 yards; batch trucks 8 yards and up; Oil distributor drivers; Oil Distributor Drivers; Trucks/Jeeps (push or pull); Traffic Control Technician

GROUP 4: Buggymobile; Semi or Truck and trailer; Dumpster; Tireman (light duty); Dump Trucks (including Rockbuggy and Truck with pups) up to and including 10 yards; Track Truck Equipment; Grease Truck; Flat Beds, dual rear axle; Hyster Operators (handling bulk aggregate); Lumber Carrier; Water Wagon, semi; Water Truck, dual axle; Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted ""A"" Frame manufactured rating over 5 tons; Bull Lifts and Fork Lifts with Power Boom and Swing attachments, over 5 tons; Front End Loader with Forks; Bus Operator over 30 passengers; All Terrain Vehicles; Boom Truck/Knuckle Truck over 5 tons; Foam Distributor Truck/dual axle; Hydro-seeders, dual axle; Vacuum Trucks, Truck Vacuum Sweepers; Loadmaster (air and water); Air Cushion or similar type vehicle; Fire Truck/Ambulance Driver; Combination Truck-fuel and grease; Compactor (when pulled by rubber tired equipment); Rigger (air/water/oilfield); Ready Mix, up to and including 7 yards;

GROUP 5: Gravel Spreader Box Operator on Truck; Flat Beds, single rear axle; Boom Truck/Knuckle Truck up to and including 5 tons; Pickups (Pilot Cars and all light duty vehicles); Water Wagon (Below 250 Bbls); Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted ""A"" Frame, manufactured rating 5 tons and under; Bull Lifts and Fork Lifts (fork lifts with power broom and swing attachments up to and including 5 tons); Buffer Truck; Tack Truck; Farm type Rubber Tired Tractor (when material handling or pulling wagons on a construction project); Foam Distributor, single axle; Hydro-Seeders, single axle; Team Drivers (horses, mules and similar equipment); Fuel Handler (station/bulk attendant); Batch Truck, up to and including 7 yards; Gear/Supply Truck; Bus Operator, Up to 30 Passengers; Rigger/Swamper

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave

for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was

updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

MINIMUM RATES OF PAY
For Laborers and Mechanics

Effective April 1, 2025 Issue 50

PAMPHLET No. 600

Title 36. Public Contracts
AS 36.05

DEPARTMENT OF LABOR
AND WORKFORCE DEVELOPMENT
Wage and Hour

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THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Labor and Workforce Development

Office of the Commissioner

Post Office Box 111149
Juneau, Alaska 99811
Main: 907.465.2700
fax: 907.465-2784

April 1, 2025

TO ALL CONTRACTING AGENCIES:

At the Alaska Department of Labor and Workforce Development our goal is putting Alaskans to work. This pamphlet is designed to help contractors awarded public construction contracts understand the most significant laws of the State of Alaska pertaining to prevailing wages.

This pamphlet identifies current prevailing wage rates for public construction contracts (any construction projects awarded for the State of Alaska or its political subdivisions, such as local governments and certain non-profit organizations). Because these rates may change in a subsequent determination, please be sure you are using the appropriate rates. The rates published in this edition become effective April 1, 2025.

The prevailing wage rates contained in this pamphlet are applicable to public construction projects with a final bid date of April 11, 2025, or later. As the law now provides, these rates will remain stable during the life of a contract or for 24 calendar months, whichever is shorter. **The 24-month period begins on the date the prime contract is awarded.** Upon expiration of the initial 24-month period, the latest wage rates issued by the department shall become effective for a subsequent 24-month period or until the original contract is completed, whichever occurs first. This process shall be repeated until the original contract is completed.

The term "original contract" means the signed contract that resulted from the original bid and any amendments, including changes of work scope, additions, extensions, change orders, and other instruments agreed to by the parties that have not been subject to subsequent open bid procedures.

If a higher federal rate is required due to partial federal funding or other federal participation, the higher rate must be paid.

For additional copies of this pamphlet go to: http://labor.state.ak.us/lss/pamp600.htm

For questions regarding prevailing wage or employment preference requirements, please contact the nearest Wage and Hour office. These offices are listed on Page x.

Sincerely,

Catherine Muñoz
Commissioner

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Note to Readers: The statutes and administrative regulations listed in this publication were taken from the official codes, as of the effective date of the publication. However, there may be errors or omissions that have not been identified and changes that occurred after the publication was printed. This publication is intended as an informational guide only and is not intended to serve as a precise statement of the statutes and regulations of the State of Alaska. To be certain of current laws and regulations, please refer to the official codes.

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EXCERPTS FROM ALASKA LAW

Sec. 36.05.005. Applicability.
This chapter applies only to a public construction contract that exceeds $25,000.

Sec. 36.05.010. Wage rates on public construction.
A contractor or subcontractor who performs work on a public construction contract in the state shall pay not less than the current prevailing rate of wages for work of a similar nature in the region in which the work is done. The current prevailing rate of wages is that contained in the latest determination of prevailing rate of wages issued by the Department of Labor and Workforce Development at least 10 days before the final date for submission of bids for the contract. The rate shall remain in effect for the life of the contract or for 24 calendar months, whichever is shorter. At the end of the initial 24-month period, if new wage determinations have been issued by the department, the latest wage determination shall become effective for the next 24-month period or until the contract is completed, whichever occurs first. This process shall be repeated until the contract is completed.

Sec. 36.05.040. Filing schedule of employees, wages paid, and other information.
All contractors or subcontractors who perform work on a public construction contract for the state or for a political subdivision of the state shall, before the Friday of every second week, file with the Department of Labor and Workforce Development a sworn affidavit for the previous reporting period, setting out in detail the number of persons employed, wages paid, job classification of each employee, hours worked each day and week, and other information on a form provided by the Department of Labor and Workforce Development.

Sec. 36.05.045. Notice of work and completion; withholding of payment.

(a) Before commencing work on a public construction contract, the person entering into the contract with a contracting agency shall designate a primary contractor for purposes of this section. Before work commences, the primary contractor shall file a notice of work with the Department of Labor and Workforce Development. The notice of work must list work to be performed under the public construction contract by each contractor who will perform any portion of work on the contract and the contract price being paid to each contractor. The primary contractor shall pay all filing fees for each contractor performing work on the contract, including a filing fee based on the contract price being paid for work performed by the primary contractor's employees. The filing fee payable shall be the sum of all fees calculated for each contractor. The filing fee shall be one percent of each contractor's contract price. The total filing fee payable by the primary contractor under this subsection may not exceed $5,000. In this subsection, "contractor" means an employer who is using employees to perform work on the public construction contract under the contract or a subcontract.

(b) Upon completion of all work on the public construction contract, the primary contractor shall file with the Department of Labor and Workforce Development a notice of completion together with payment of any additional filing fees owed due to increased contract amounts. Within 30 days after the department's receipt of the primary contractor's notice of completion, the department shall inform the contracting agency of the amount, if any, to be withheld from the final payment.

(c) A contracting agency

(1) may release final payment of a public construction contract to the extent that the agency has received verification from the Department of Labor and Workforce Development that

(A) the primary contractor has complied with (a) and (b) of this section;

(B) the Department of Labor and Workforce Development is not conducting an investigation under this title; and

(C) the Department of Labor and Workforce Development has not issued a notice of a violation of this chapter to the primary contractor or any other contractors working on the public construction contract; and

(2) shall withhold from the final payment an amount sufficient to pay the department's estimate of what may be needed to compensate the employees of any contractors under investigation on this construction contract, and any unpaid filing fees.

(d) The notice and filing fee required under (a) of this section may be filed after work has begun if
   (1) The public construction contract is for work undertaken in immediate response to an emergency; and
   (2) The notice and fees are filed not later than 14 days after the work has begun.

(e) A false statement made on a notice required by this section is punishable under AS 11.56.210.

Sec. 36.05.060. Penalty for violation of this chapter.

A contractor who violates this chapter is guilty of a misdemeanor and upon conviction is punishable by a fine of not less than $100 nor more than $1,000, or by imprisonment for not less than 10 days nor more than 90 days, or by both. Each day a violation exists constitutes a separate offense.

Sec. 36.05.070. Wage rates in specifications and contracts for public works.

(a) The advertised specifications for a public construction contract that requires or involves the employment of mechanics, laborers, or field surveyors must contain a provision stating the minimum wages to be paid various classes of laborers, mechanics, or field surveyors and that the rate of wages shall be adjusted to the wage rate under AS 36.05.010.

(b) Repealed by §17 ch 142 SLA 1972.

(c) A public construction contract under (a) of this section must contain provisions that
   (1) the contractor or subcontractors of the contractor shall pay all employees unconditionally and not less than once a week;
   (2) wages may not be less than those stated in the advertised specifications, regardless of the contractual relationship between the contractor or subcontractors and laborers, mechanics, or field surveyors;
   (3) the scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of the work;
   (4) the state or a political subdivision shall withhold so much of the accrued payments as is necessary to pay to laborers, mechanics, or field surveyors employed by the contractor or subcontractors the difference between
      (A) the rates of wages required by the contract to be paid laborers, mechanics, or field surveyors on the work; and
      (B) the rates of wages in fact received by laborers, mechanics, or field surveyors.

Sec. 36.05.080. Failure to pay agreed wages.

Every contract within the scope of AS 36.05.070 shall contain a provision that if it is found that a laborer, mechanic, or field surveyor employed by the contractor or subcontractor has been or is being paid a rate of wages less than the rate of wages required by the contract to be paid, the state or its political subdivision may, by written notice to the contractor, terminate the contractor's right to proceed with the work or the part of the work for which there is a failure to pay the required wages and to prosecute the work to completion by contract or otherwise, and the contractor and the contractor's sureties are liable to the state or its political subdivision for excess costs for completing the work.

Sec. 36.05.090. Payment of wages from withheld payments and listing contractors who violate contracts.

(a) The state disbursing officer in the case of a state public construction contract and the local fiscal officer in the case of a political subdivision public construction contract shall pay directly to laborers, mechanics, or field surveyors from accrued payments withheld under the terms of the contract the wages due laborers, mechanics, or field surveyors under AS 36.05.070.

(b) The state disbursing officer or the local fiscal officer shall distribute to all departments of the state government and to all political subdivisions of the state a list giving the names of persons who have disregarded their obligations to employees. A person appearing on this list and a firm, corporation, partnership, or association in which the person has an interest may not work as a contractor or

subcontractor on a public construction contract for the state or a political subdivision of the state until three years after the date of publication of the list. If the accrued payments withheld under the contract are insufficient to reimburse all the laborers, mechanics, or field surveyors with respect to whom there has been a failure to pay the wages required under AS 36.05.070, the laborers, mechanics, or field surveyors have the right of action or intervention or both against the contractor and the contractor's sureties conferred by law upon persons furnishing labor or materials, and in the proceedings it is not a defense that the laborers, mechanics, or field surveyors accepted or agreed to accept less than the required rate of wages or voluntarily made refunds.

Sec. 36.05.900. Definition.
In this chapter, "contracting agency" means the state or a political subdivision of the state that has entered into a public construction contract with a contractor.

EXCERPTS FROM ALASKA ADMINISTRATIVE CODE

Notice:** Regulations relating to board and lodging and per diem went into effect on November 25, 2018. The new regulations are excerpted here

8 AAC 30.051. Purpose. The purpose of 8 AAC 30.052 – 8 AAC 30.056 is to ensure that wages paid to laborers, mechanics, and field surveyors do not fall below the prevailing rate of pay.

8 AAC 30.052. Board and lodging; remote sites. (a) A contractor on a public construction project located 65 or more road miles from the international airport closest to the project area in either Fairbanks, Juneau, or Anchorage, or that is inaccessible by road in a two-wheel drive vehicle, shall provide adequate board and lodging to each laborer, mechanic, or field surveyor while the person is employed on the project. If commercial lodging facilities are not available, the contractor shall provide temporary lodging facilities. Lodging facilities must comply with all applicable state and federal laws. For a highway project, the location of the project is measured from the midpoint of the project.

(b) A contractor is not required to provide board and lodging:

(1) to a laborer, mechanic, or field surveyor who is a domiciled resident of the project area; or

(2) on a laborer, mechanic, or field surveyor's scheduled days off, when the person can reasonably travel between the project and the person's permanent residence; for the purposes of this paragraph, "scheduled day off" means a day in which a person does not perform work on-site, is not required to remain at or near the job location for the benefit of the contractor, and is informed of the day off at least seven days before the day off.

(c) Upon a contractor's written request, the commissioner may waive the requirements of (a) of this section where:

(1) the project is inaccessible by road in a two-wheel drive vehicle, but the laborer, mechanic, or field surveyor can reasonably travel between the project and the person's permanent residence within one hour; or

(2) a laborer, mechanic, or field surveyor is not a domiciled resident of the project area, but has established permanent residence, with the intent to remain indefinitely, within 65 road miles of the project, or for a highway project, the mid-point of the project.

8 AAC 30.054. Per diem instead of board and lodging. (a) A contractor may pay a laborer, mechanic, or field surveyor per diem instead of providing board and lodging, when the following conditions are met:

(1) the department determines that per diem instead of board and lodging is an established practice for the work classification; the department shall publish and periodically revise its determinations in the pamphlet *Laborers and Mechanics Minimum Rates of Pay*;

(2) the contractor pays each laborer, mechanic, or field surveyor the appropriate per diem rate as published and periodically revised in the pamphlet *Laborers and Mechanics Minimum Rates of Pay*; and

(3) the contractor pays the per diem to each laborer, mechanic, or field surveyor on the same day that wages are paid.

(b) A contractor may not pay per diem instead of board and lodging on a highway project located

(1) west of Livengood on the Elliot Highway, AK-2;

(2) on the Dalton Highway, AK-11;

(3) north of milepost 20 on the Taylor Highway, AK-5;

(4) east of Chicken on the Top of the World Highway; or

(5) south of Tetlin Junction to the Alaska-Canada border on the Alaska Highway, AK-2.

8 AAC 30.056. Alternative arrangement. Upon a contractor's written request, the commissioner may approve an alternative board and lodging or per diem arrangement, provided

(1) the arrangement does not reduce the laborer, mechanic, or field surveyor's wages below the prevailing wage rate; and

(2) the laborer, mechanic, or field surveyor voluntarily enters into and signs the written arrangement; a labor organization representing laborers, mechanics, or field surveyors may enter into the written agreement on their behalf.

8 AAC 30.900. General definitions (selected excerpts only):

In this chapter and in AS 36

(22) "domiciled resident" means a person living within 65 road miles of a public construction project, or in the case of a highway project, the mid-point of the project, for at least 12 consecutive months prior to the award of the public construction project;

(23) "employed on the project" means the time period from the date the laborer, mechanic, or field surveyor first reports on-site to the project through the final date the person reports on-site to the project.

ADDITIONAL INFORMATION

PER DIEM

Notice: New regulations relating to board and lodging and per diem went into effect on November 25, 2018. The regulations provide a comprehensive set of requirements for the provision of board and lodging or per diem for workers on remote projects. Please refer to Alaska Administrative Code 8 AAC Chapter 30 and read the chapter carefully.

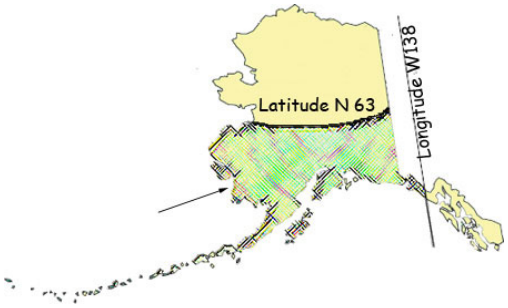
The Alaska Department of Labor and Workforce Development has determined that per diem is an established work practice for certain work classifications. These classifications are indicated throughout the Pamphlet by an asterisk (*) under the classification title. If all of the conditions of 8 AAC 30.054 are met, an employer may pay workers in these classifications per diem instead of providing board and lodging on a remote project.

Per Diem Rate: As of May 1, 2019, the minimum per diem rate is $100.00 per day, or part thereof, the worker is employed on the project. In the event that a contractor provides lodging facilities, but no meals, the department will accept a payment of $48 per day for meals to meet the per diem requirements.

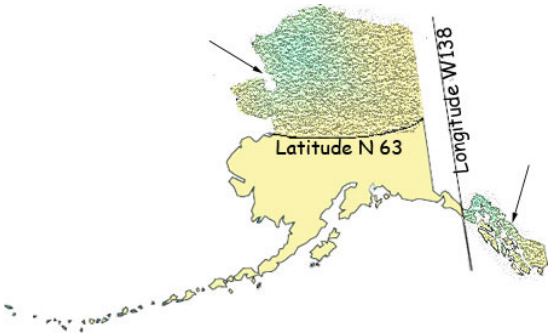
LABORER CLASSIFICATION CLARIFICATION

The laborer rates categorized in class code S1201-S1206 apply in one area of Alaska; the area that is south of N63 latitude and west of W138 Longitude. The laborer rates categorized in class code N1201-N1206 apply in two areas of Alaska; the Alaska areas north of N63 latitude and east of W138 longitude. The following graphic representations should assist with clarifying the applicable wage rate categories:

S1201-
S1206



N1201-
N1206



APPRENTICE RATES

Apprentice rates at less than the minimum prevailing rates may be paid to apprentices according to an apprentice program which has been registered and approved by the Commissioner of the Alaska Department of Labor and Workforce Development in writing or according to a bona fide apprenticeship program registered with the U.S. Department of Labor, Office of Apprenticeship Training. **Any employee listed on a payroll at an apprentice wage rate who is not registered as above shall be paid the journeyman prevailing minimum wage in that work classification.** Wage rates are based on prevailing crew makeup practices in Alaska and apply to work performed regardless of either the quality of the work performed by the employee or the titles or classifications which may be assigned to individual employees.

FRINGE BENEFIT PLANS

Contractors/subcontractors may compensate fringe benefits to their employees in any one of three methods. The fringe benefits may be paid into a union trust fund, into an approved benefit plan, or paid directly on the paycheck as gross wages.

Where fringe benefits are paid into approved plans, funds, or programs including union trust funds, the payments must be contributed at least monthly. If contractors submit their own payroll forms and are paying fringe benefits into approved plans, funds, or programs, the employer's certification must include, in addition to those requirements of 8 AAC 30.020(c), a statement that fringe benefit payments have been or will be paid at least monthly. Contractors who pay fringe benefits to a plan must ensure the plan is one approved by the Internal Revenue Service and that the plan meets the requirements of 8 AAC 30.025 (eff. 3/2/08) in order for payments to be credited toward the prevailing wage obligation.

SPECIAL PREVAILING WAGE RATE DETERMINATION

Special prevailing wage rate determinations may be requested for special projects or a special worker classification if the work to be performed does not conform to traditional public construction for which a prevailing wage rate has been established under 8 AAC 30.050(a) of this section. Requests for special wage rate determinations must be in writing and filed with the Commissioner at least 30 days before the award of the contract. An applicant for a special wage rate determination shall have the responsibility to support the necessity for the special rate. An application for a special wage rate determination filed under this section must contain:

(1) a specification of the contract or project on which the special rates will apply and a description of the work to be performed;
(2) a brief narrative explaining why special wage rates are necessary;
(3) the job class or classes involved;
(4) the special wage rates the applicant is requesting, including survey or other relevant wage data to support the requested rates;
(5) the approximate number of employees who would be affected; and
(6) any other information which might be helpful in determining if special wage rates are appropriate.

Requests made pursuant to the above should be addressed to:

Director
Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division
Wage and Hour
P.O. Box 111149
Juneau, AK 99811-1149
-or-
Email: statewide.wagehour@alaska.gov

EMPLOYMENT PREFERENCE INFORMATION

In October 2019, the Alaska Attorney General issued a formal opinion stating that the Alaska Statutes 36.10.150 of the State's 90% Employment Preference law, also known as the Alaska Resident Hire law, violates both the U.S. and Alaska Constitutions. As a result, the state has stopped all enforcement activity.
A copy of the Attorney General opinion is found here:

http://law.alaska.gov/pdf/opinions/opinions_2019/19-005_AK-hire.pdf

Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division
Wage and Hour
Web site: http://labor.state.ak.us/lss/pamp600.htm

Anchorage	Juneau	Fairbanks
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LABOR STANDARDS AND SAFETY NOTICE REQUESTS

If you would like to receive Wage and Hour or Mechanical Inspection **regulation notices** or **publications information**, they are available via electronic mail, by signing up in the GovDelivery System, https://public.govdelivery.com/accounts/AKDOL/subscriber/new and selecting topics *LSS – Wage and Hour – Forms and Publications*, *LSS – Mechanical Inspection Regulations*, or *LSS – Wage and Hour Regulations*.

Publications are also available online at http://labor.alaska.gov/lss/home.htm

DEBARMENT LIST

AS 36.05.090(b) states that "the state disbursing officer or the local fiscal officer shall distribute to all departments of the state government and to all political subdivisions of the state a list giving the names of persons who have disregarded their obligations to employees."

A person appearing on the following debarment list and a firm, corporation, partnership, or association in which the person has an interest may not work as a contractor or subcontractor on a public construction contract for the state or a political subdivision of the state for three years from the date of debarment.

Company Name	Debarment Expires

No companies are currently debarred.

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Laborers' & Mechanics' Minimum Rates of Pay

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
Boilermakers								
	*See per diem note on last page							
						VAC	**SAF**	
A0101	Boilermaker (journeyman)	54.08	8.57	18.72	2.50	4.25	0.34	88.46
Bricklayers & Allied Craftworkers								
	*See per diem note on last page							
						L&M	**ANU**	
A0201	Blocklayer, including:	52.77		9.91	0.66	0.20	2.45	65.99
	Bricklayer Marble Mason Refractory Worker (Firebrick, Plastic, Castable, and Gunite Refractory Applications) Stone Mason Terrazzo Worker Tile Setter							
						L&M	**ANU**	
A0202	Pointer/Caulker/Cleaner (PCC)	52.77		9.91	0.66	0.20	2.45	65.99
	Caulker Cleaner Tuck Pointer							
						L&M	**ANU**	
A0203	Finisher	40.91		10.03	0.54	0.20	2.45	54.13
	Marble Finisher Terrazzo Finisher Tile Finisher							
						L&M	**ANU**	
A0204	Torginal Applicator	40.91		10.03	0.54	0.20	2.45	54.13
Carpenters, Region I (North of 63 latitude)								
	*See per diem note on last page							
						L&M	**SAF**	
N0301	Carpenter (journeyman)	50.79	8.75	16.80	0.77	0.10		77.21
	Lather/Drywall/Acoustical							
Carpenters, Region II (South of N63 latitude)								
	*See per diem note on last page							
						L&M	**SAF**	
S0301	Carpenter (journeyman)	50.79	8.75	17.34	0.77	0.10		77.75

Wage benefits key: ANU=Annuity, BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
Carpenters, Region II (South of N63 latitude) *See per diem note on last page								
						L&M	SAF	
S0301	Carpenter (journeyman)	50.79	8.75	17.34	0.77	0.10		77.75
	Lather/Drywall/Acoustical							
Cement Masons *See per diem note on last page								
						L&M		
A0401	Group I, including:	49.28	8.80	11.80	1.68	0.10		71.66
	Application of Sealing Compound							
	Application of Underlayment							
	Building, General							
	Cement Finisher							
	Cement Mason (journeyman)							
	Concrete							
	Concrete Paving							
	Concrete Polishing							
	Concrete Repair							
	Curb & Gutter, Sidewalk							
	Curing of All Concrete							
	General Concrete Pour Tender							
	Grouting & Caulking of Tilt-Up Panels							
	Grouting of All Plates							
	Patching Concrete							
	Screed Pin Setter							
	Screeder or Rodder							
	Spackling/Skim Coating							
						L&M		
A0402	Group II, including:	49.28	8.80	11.80	1.68	0.10		71.66
	Form Setter							
						L&M		
A0403	Group III, including:	49.28	8.80	11.80	1.68	0.10		71.66
	Concrete Saw Cutter Operator (All Control Joints and Self-powered)							
	Curb & Gutter Machine							
	Floor Grinder							
	Pneumatic Power Tools							
	Power Chipping & Bushing							
	Sand Blasting Architectural Finish							
	Screed & Rodding Machine Operator							
	Troweling Machine Operator (all concrete surfaces)							
						L&M		
A0404	Group IV, including:	49.28	8.80	11.80	1.68	0.10		71.66

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Cement Masons							
	*See per diem note on last page						
A0404	Group IV, including:	49.28	8.80	11.80	1.68	L&M 0.10	71.66
	Acoustical or Imitation Acoustical Finish						
	Application of All Composition Mastic						
	Application of All Epoxy Finishes on Concrete Surfaces						
	Application of All Plastic Material						
	Finish Colored Concrete						
	Gunite Nozzleman						
	Hand Powered Grinder						
	Preparing, scratching and browsing of all ceilings and walls, finished with terrazo or tile						
	Tunnel Worker						
A0405	Group V, including:	49.28	8.80	11.80	1.68	L&M 0.10	71.66
	Casting and finishing						
	EIFS Systems						
	Finishing of all interior and exterior plastering						
	Fireproofing (Pryocrete, Cafco, Albi-Clad, sprayed fiberglass)						
	Gypsum, Portland Cement						
	Kindred material and products						
	Operation and control of all types of plastering machines, including power tools and floats, used by the industry						
	Overcoating and maintenance of interior/exterior plaster surfaces						
	Plasterer						
	Support and control of all concrete 3D printing operations (Excluding Paint)						
	Use of 3D structural and architectural printing and finishes						
	Use of sustainable materials and equipment practices						
	Veneer plastering process (Rapid Plaster, U.S.G. "Imperial Systems", and Pabcoat Systems")						
	Venetian plaster and color-integrated Italian/Middle-Eastern line plaster						
Culinary Workers							
A0501	Baker/Cook	29.95	7.53	8.83		LEG	46.31
A0503	General Helper	25.92	7.53	8.83		LEG	42.28
	Housekeeper						
	Janitor						
	Kitchen Helper						

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Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
Culinary Workers								
A0504	Head Cook	29.95	7.53	8.83		**LEG**		46.31
A0505	Head Housekeeper	26.20	7.53	8.83		**LEG**		42.56
	Head Kitchen Help							
Dredgemen	*See per diem note on last page							
A0601	Assistant Engineer	52.32	12.10	16.25	1.05	**L&M** 0.10		81.82
	Craneman Electrical Generator Operator (primary pump/power barge/dredge) Engineer Welder							
A0602	Assistant Mate (deckhand)	50.93	12.10	16.25	1.05	**L&M** 0.10		80.43
A0603	Fireman	51.46	12.10	16.25	1.05	**L&M** 0.10		80.96
A0605	Leverman Clamshell	55.33	12.10	16.25	1.05	**L&M** 0.10		84.83
A0606	Leverman Hydraulic	53.23	12.10	16.25	1.05	**L&M** 0.10		82.73
A0607	Mate & Boatman	52.32	12.10	16.25	1.05	**L&M** 0.10		81.82
A0608	Oiler (dredge)	51.46	12.10	16.25	1.05	**L&M** 0.10		80.96
Electricians	*See per diem note on last page							
A0701	Inside Cable Splicer	53.44	14.83	14.49	0.95	**L&M** 0.25	**LEG** 0.15	84.11
A0702	Inside Journeyman Wireman, including:	53.44	14.83	14.49	0.95	**L&M** 0.25	**LEG** 0.15	84.11
	Technicians (including use of drones in electrical construction)							
A0703	Power Cable Splicer	74.34	14.83	19.92	0.95	**L&M** 0.25	**LEG** 0.15	110.44
A0704	Tele Com Cable Splicer	55.28	14.83	18.56	0.95	**L&M** 0.25	**LEG** 0.15	90.02

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Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
Electricians								
	*See per diem note on last page							
						L&M	**LEG**	
A0705	Power Journeyman Lineman, including:	72.59	14.83	19.87	0.95	0.25	0.15	108.64
	Power Equipment Operator Technician (including use of drones in electrical construction)							
						L&M	**LEG**	
A0706	Tele Com Journeyman Lineman, including:	53.53	14.83	18.51	0.95	0.25	0.15	88.22
	Technician (including use of drones in telecommunications construction) Tele Com Equipment Operator							
						L&M	**LEG**	
A0707	Straight Line Installer - Repairman	53.53	14.83	18.51	0.95	0.25	0.15	88.22
						L&M	**LEG**	
A0708	Powderman	70.59	14.83	19.81	0.95	0.25	0.15	106.58
						L&M	**LEG**	
A0710	Material Handler	29.57	15.34	5.89	0.15	0.15	0.15	51.25
						L&M	**LEG**	
A0712	Tree Trimmer Groundman	32.97	14.83	14.84	0.15	0.15	0.15	63.09
						L&M	**LEG**	
A0713	Journeyman Tree Trimmer	42.23	14.83	15.12	0.15	0.15	0.15	72.63
						L&M	**LEG**	
A0714	Vegetation Control Sprayer	45.91	14.83	15.23	0.15	0.15	0.15	76.42
						L&M	**LEG**	
A0715	Inside Journeyman Communications CO/PBX	53.44	14.83	14.49	0.95	0.25	0.15	84.11
Elevator Workers								
	*See per diem note on last page							
						L&M	**VAC**	
A0802	Elevator Constructor	50.01	16.28	21.36	0.80	1.60	5.55	95.60
						L&M	**VAC**	
A0803	Elevator Constructor Mechanic	71.44	16.28	21.36	0.80	1.60	7.93	119.41
Heat & Frost Insulators/Asbestos Workers (North of 63rd Parallel)								
	*See per diem note on last page							
						IAF	**LML**	
N0902	Asbestos Abatement-Mechanical Systems	43.85	9.24	11.13	1.50	0.18	0.05	65.95
						IAF	**LML**	
N0903	Asbestos Abatement/General Demolition All Systems	43.85	9.24	11.13	1.50	0.18	0.05	65.95
						IAF	**LML**	
N0904	Insulator, Group II	43.85	9.24	11.13	1.50	0.18	0.05	65.95

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Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
Heat & Frost Insulators/Asbestos Workers (North of 63rd Parallel) *See per diem note on last page								
						IAF	**LML**	
N0905	Fire Stop	43.85	9.24	11.13	1.50	0.18	0.05	65.95
Heat & Frost Insulators/Asbestos Workers (South of 63rd Parallel) *See per diem note on last page								
						IAF	**LML**	
S0902	Asbestos Abatement-Mechanical Systems	43.35	9.24	11.13	1.50	0.18	0.05	65.45
						IAF	**LML**	
S0903	Asbestos Abatement/General Demolition All Systems	43.35	9.24	11.13	1.50	0.18	0.05	65.45
						IAF	**LML**	
S0904	Insulator, Group II	43.35	9.24	11.13	1.50	0.18	0.05	65.45
						IAF	**LML**	
S0905	Fire Stop	43.35	9.24	11.13	1.50	0.18	0.05	65.45
IronWorkers *See per diem note on last page								
						L&M	**IAF**	
A1101	Ironworkers, including:	46.49	10.16	26.45	0.87	0.20	0.24	84.41
	Bender Operators Bridge & Structural Hangar Doors Hollow Metal Doors Industrial Doors Machinery Mover Mass Timber Construction (Cross Laminate Timber) Ornamental Reinforcing Rigger Sheeter Signalman Stage Rigger Toxic Haz-Mat Work Welder							
						L&M	**IAF**	
A1102	Helicopter	47.49	10.16	26.45	0.87	0.20	0.24	85.41
	Helicopter (used for rigging and setting) Tower (energy producing windmill type towers to include nacelle and blades)							
						L&M	**IAF**	
A1103	Fence/Barrier Installer	42.99	10.16	26.45	0.87	0.20	0.24	80.91

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Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
IronWorkers								
	*See per diem note on last page							
						L&M	**IAF**	
A1104	Guard Rail Layout Man	43.73	10.16	26.45	0.87	0.20	0.24	81.65
						L&M	**IAF**	
A1105	Guard Rail Installer	43.99	10.16	26.45	0.87	0.20	0.24	81.91
Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)								
	*See per diem note on last page							
						L&M	**LEG**	
N1201	Group I, including:	40.25	10.55	21.51	2.00	0.35	0.20	74.86

Asphalt Worker (shovelman, plant crew)
Brush Cutter
Camp Maintenance Laborer
Carpenter Tender or Helper
Choke Setter, Hook Tender, Rigger, Signalman
Concrete Labor (curb & gutter, chute handler, curing, grouting, screeding)
Crusher Plant Laborer
Demolition Laborer
Ditch Digger
Dumpman
Environmental Laborer (hazard/toxic waste, oil spill)
Fence Installer
Fire Watch Laborer
Flagman
Form Stripper
General Laborer
Guardrail Laborer, Bridge Rail Installer
Hydro Seeder Nozzleman
Laborer, Building
Landscaper or Planter
Laying of Mortarless Decorative Block (retaining walls, flowered decorative block 4 feet or less - highway or landscape work)
Material Handler
Pneumatic or Power Tools
Portable or Chemical Toilet Serviceman
Pump Man or Mixer Man
Railroad Track Laborer
Sandblast, Pot Tender
Saw Tender
Slurry Work
Steam Cleaner Operator
Steam Point or Water Jet Operator

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
						L&M	LEG	
Laborers (The Alaska areas north of N63 latitude and east of W138 longitude) *See per diem note on last page								
N1201	Group I, including:	40.25	10.55	21.51	2.00	0.35	0.20	74.86
	Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)							
	Tank Cleaning							
	Utiliwalk & Utilidor Laborer							
	Watchman (construction projects)							
	Window Cleaner							
						L&M	LEG	
N1202	Group II, including:	41.25	10.55	21.51	2.00	0.35	0.20	75.86
	Burning & Cutting Torch							
	Cement or Lime Dumper or Handler (sack or bulk)							
	Certified Erosion Sediment Control Lead (CESCL Laborer)							
	Choker Splicer							
	Chucktender (wagon, air-track & hydraulic drills)							
	Concrete Laborer (power buggy, concrete saws, pumpcrete nozzleman, vibratorman)							
	Culvert Pipe Laborer							
	Cured Inplace Pipelayer							
	Environmental Laborer (asbestos, marine work)							
	Floor Preparation, Core Drilling							
	Foam Gun or Foam Machine Operator							
	Green Cutter (dam work)							
	Gunite Operator							
	Hod Carrier							
	Jackhammer/Chipping Gun or Pavement Breaker							
	Laser Instrument Operator							
	Laying of Mortarless Decorative Block (retaining walls, flowered decorative block over 4 feet - highway or landscape work)							
	Mason Tender & Mud Mixer (sewer work)							
	Pilot Car							
	Pipelayer Helper							
	Plasterer, Bricklayer & Cement Finisher Tender							
	Powderman Helper							
	Power Saw Operator							
	Railroad Switch Layout Laborer							
	Sandblaster							
	Scaffold Building & Erecting							
	Sewer Caulker							
	Sewer Plant Maintenance Man							
	Thermal Plastic Applicator							
	Timber Faller, Chainsaw Operator, Filer							
	Timberman							

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
						L&M	LEG	
Laborers (The Alaska areas north of N63 latitude and east of W138 longitude) *See per diem note on last page								
N1203	Group III, including:	42.15	10.55	21.51	2.00	0.35	0.20	76.76
	Bit Grinder Camera/Tool/Video Operator Guardrail Machine Operator High Rigger & Tree Topper High Scaler Multiplate Plastic Welding Slurry Seal Squeegee Man Traffic Control Supervisor Welding Certified (in connection with laborer's work)							
						L&M	LEG	
N1204	Group IIIA	46.53	10.55	21.51	2.00	0.35	0.20	81.14
	Asphalt Raker, Asphalt Belly Dump Lay Down Drill Doctor (in the field) Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills) Pioneer Drilling & Drilling Off Tugger (all type drills) Pipelayers Powderman (Employee Possessor) Storm Water Pollution Protection Plan Specialist (SWPPP Specialist) Traffic Control Supervisor, DOT Qualified							
						L&M	LEG	
N1205	Group IV	29.82	10.55	21.51	2.00	0.35	0.20	64.43
	Final Building Cleanup Permanent Yard Worker							
						L&M	LEG	
N1206	Group IIIB	54.01	5.50	21.51	1.60	0.35	0.20	83.17
	Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours) Federal Powderman (Responsible Person in Charge) Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones) Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours) Stake Hopper							
Laborers (The area that is south of N63 latitude and west of W138 longitude) *See per diem note on last page								
						L&M	LEG	
S1201	Group I, including:	40.25	10.55	21.51	2.00	0.35	0.20	74.86
	Asphalt Worker (shovelman, plant crew)							

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Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	L&M	LEG	THR

Laborers (The area that is south of N63 latitude and west of W138 longitude)
*See per diem note on last page

							L&M	LEG	
S1201	Group I, including:	40.25	10.55	21.51	2.00		0.35	0.20	74.86

Brush Cutter
Camp Maintenance Laborer
Carpenter Tender or Helper
Choke Setter, Hook Tender, Rigger, Signalman
Concrete Labor (curb & gutter, chute handler, curing, grouting, screeding)
Crusher Plant Laborer
Demolition Laborer
Ditch Digger
Dumpman
Environmental Laborer (hazard/toxic waste, oil spill)
Fence Installer
Fire Watch Laborer
Flagman
Form Stripper
General Laborer
Guardrail Laborer, Bridge Rail Installer
Hydro Seeder Nozzleman
Laborer, Building
Landscaper or Planter
Laying of Mortarless Decorative Block (retaining walls, flowered decorative block 4 feet or less - highway or landscape work)
Material Handler
Pneumatic or Power Tools
Portable or Chemical Toilet Serviceman
Pump Man or Mixer Man
Railroad Track Laborer
Sandblast, Pot Tender
Saw Tender
Slurry Work
Steam Cleaner Operator
Steam Point or Water Jet Operator
Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)
Tank Cleaning
Utiliwalk & Utilidor Laborer
Watchman (construction projects)
Window Cleaner

							L&M	LEG	
S1202	Group II, including:	41.25	10.55	21.51	2.00		0.35	0.20	75.86

Burning & Cutting Torch

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	L&M	LEG	THR

Laborers (The area that is south of N63 latitude and west of W138 longitude)
*See per diem note on last page

							L&M	LEG	
S1202	Group II, including:	41.25	10.55	21.51	2.00		0.35	0.20	75.86

Cement or Lime Dumper or Handler (sack or bulk)
Certified Erosion Sediment Control Lead (CESCL Laborer)
Choker Splicer
Chucktender (wagon, air-track & hydraulic drills)
Concrete Laborer (power buggy, concrete saws, pumpcrete nozzleman, vibratorman)
Culvert Pipe Laborer
Cured Inplace Pipelayer
Environmental Laborer (asbestos, marine work)
Floor Preparation, Core Drilling
Foam Gun or Foam Machine Operator
Green Cutter (dam work)
Gunite Operator
Hod Carrier
Jackhammer/Chipping Gun or Pavement Breaker
Laser Instrument Operator
Laying of Mortarless Decorative Block (retaining walls, flowered decorative block over 4 feet - highway or landscape work)
Mason Tender & Mud Mixer (sewer work)
Pilot Car
Pipelayer Helper
Plasterer, Bricklayer & Cement Finisher Tender
Powderman Helper
Power Saw Operator
Railroad Switch Layout Laborer
Sandblaster
Scaffold Building & Erecting
Sewer Caulker
Sewer Plant Maintenance Man
Thermal Plastic Applicator
Timber Faller, Chainsaw Operator, Filer
Timberman

							L&M	LEG	
S1203	Group III, including:	42.15	10.55	21.51	2.00		0.35	0.20	76.76

Bit Grinder
Camera/Tool/Video Operator
Guardrail Machine Operator
High Rigger & Tree Topper
High Scaler
Multiplate
Plastic Welding

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
Laborers (The area that is south of N63 latitude and west of W138 longitude) *See per diem note on last page								
						L&M	LEG	
S1203	Group III, including:	42.15	10.55	21.51	2.00	0.35	0.20	76.76
	Slurry Seal Squeegee Man Traffic Control Supervisor Welding Certified (in connection with laborer's work)							
						L&M	LEG	
S1204	Group IIIA	46.53	10.55	21.51	2.00	0.35	0.20	81.14
	Asphalt Raker, Asphalt Belly Dump Lay Down Drill Doctor (in the field) Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills) Pioneer Drilling & Drilling Off Tugger (all type drills) Pipelayers Powderman (Employee Possessor) Storm Water Pollution Protection Plan Specialist (SWPPP Specialist) Traffic Control Supervisor, DOT Qualified							
						L&M	LEG	
S1205	Group IV	29.82	10.55	21.51	2.00	0.35	0.20	64.43
	Final Building Cleanup Permanent Yard Worker							
						L&M	LEG	
S1206	Group IIIB	54.01	5.50	21.51	1.60	0.35	0.20	83.17
	Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours) Federal Powderman (Responsible Person in Charge) Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones) Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours) Stake Hopper							
Millwrights *See per diem note on last page								
						L&M		
A1251	Millwright (journeyman)	55.42	8.75	15.00	1.11	0.20	0.25	80.73
						L&M		
A1252	Millwright Welder	56.42	8.75	15.00	1.11	0.20	0.25	81.73
Painters, Region I (North of N63 latitude) *See per diem note on last page								
						L&M		
N1301	Group I, including:	40.33	9.97	15.10	1.10	0.10		66.60

Wage benefits key: ANU=Annuity, BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Painters, Region I (North of N63 latitude)							
	*See per diem note on last page						
						L&M	
N1301	Group I, including:	40.33	9.97	15.10	1.10	0.10	66.60
	Brush						
	General Painter						
	Hand Taping						
	Hazardous Material Handler						
	Lead-Based Paint Abatement						
	Roll						
						L&M	
N1302	Group II, including:	40.85	9.97	15.10	1.10	0.10	67.12
	Bridge Painter						
	Epoxy Applicator						
	General Drywall Finisher						
	Hand/Spray Texturing						
	Industrial Coatings Specialist						
	Machine/Automatic Taping						
	Pot Tender						
	Sandblasting						
	Specialty Painter						
	Spray						
	Structural Steel Painter						
	Wallpaper/Vinyl Hanger						
N1304	Group IV, including:	44.54	9.97	18.61	1.10	0.10	74.32
	Glazier						
	Storefront/Automatic Door Mechanic						
N1305	Group V, including:	39.66	9.97	5.00	1.10	0.10	55.83
	Carpet Installer						
	Floor Coverer						
	Heat Weld/Cove Base						
	Linoleum/Soft Tile Installer						
N1306	Group VI, including:	69.78	11.01	7.80	1.10	0.10	89.79
	Traffic Control Striper						
Painters, Region II (South of N63 latitude)							
	*See per diem note on last page						
						L&M	
S1301	Group I, including :	35.97	9.97	17.45	1.10	0.10	64.59
	Brush						

Wage benefits key: ANU=Annuity, BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Painters, Region II (South of N63 latitude) *See per diem note on last page							
						L&M	
S1301	Group I, including :	35.97	9.97	17.45	1.10	0.10	64.59
	General Painter Hand Taping Hazardous Material Handler Lead-Based Paint Abatement Roll Spray						
						L&M	
S1302	Group II, including :	37.22	9.97	17.45	1.10	0.10	65.84
	General Drywall Finisher Hand/Spray Texturing Machine/Automatic Taping Wallpaper/Vinyl Hanger						
						L&M	
S1303	Group III, including :	37.32	9.97	17.45	1.10	0.10	65.94
	Bridge Painter Epoxy Applicator Industrial Coatings Specialist Pot Tender Sandblasting Specialty Painter Structural Steel Painter						
						L&M	
S1304	Group IV, including:	45.20	9.97	17.25	1.10	0.10	73.62
	Glazier Storefront/Automatic Door Mechanic						
						L&M	
S1305	Group V, including:	39.66	9.97	5.00	1.10	0.10	55.83
	Carpet Installer Floor Coverer Heat Weld/Cove Base Linoleum/Soft Tile Installer						
S1306	Group VI, including:	69.78	11.01	7.80	1.10	0.10	89.79
	Traffic Control Striper						
Piledrivers *See per diem note on last page							

Wage benefits key: ANU=Annuity, BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Piledrivers							
	*See per diem note on last page						
						L&M **IAF**	
A1401	Piledriver	50.79	8.75	16.80	0.77	0.10	77.21
	Assistant Dive Tender						
	Carpenter/Piledriver						
	Rigger						
	Sheet Stabber						
	Skiff Operator						
						L&M **IAF**	
A1402	Piledriver-Welder/Toxic Worker	51.79	8.75	16.80	0.77	0.10	78.21
						L&M **IAF**	
A1403	Remotely Operated Vehicle Pilot/Technician	55.10	8.75	16.80	0.77	0.10	81.52
	Single Atmosphere Suit, Bell or Submersible Pilot						
						L&M **IAF**	
A1404	Diver (working) **See note on last page	94.90	8.75	16.80	0.77	0.10	121.32
						L&M **IAF**	
A1405	Diver (standby) **See note on last page	55.10	8.75	16.80	0.77	0.10	81.52
						L&M **IAF**	
A1406	Dive Tender **See note on last page	54.10	8.75	16.80	0.77	0.10	80.52
						L&M **IAF**	
A1407	Welder (American Welding Society, Certified Welding Inspector)	56.35	8.75	16.80	0.77	0.10	82.77
Plumbers, Region I (North of N63 latitude)							
	*See per diem note on last page						
						L&M **S&L**	
N1501	Journeyman Pipefitter	51.66	12.45	18.70	1.75	1.20	85.76
	Plumber						
	Welder						
Plumbers, Region II (South of N63 latitude)							
	*See per diem note on last page						
						L&M	
S1501	Journeyman Pipefitter	47.50	14.03	16.02	2.40	0.20	80.15
	Plumber						
	Welder						
Plumbers, Region IIA (1st Judicial District)							
	*See per diem note on last page						
						L&M	
X1501	Journeyman Pipefitter	50.50	15.67	12.25	2.95	0.24	81.61

Wage benefits key: ANU=Annuity, BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Plumbers, Region IIA (1st Judicial District)							
	*See per diem note on last page						
						L&M	
X1501	Journeyman Pipefitter	50.50	15.67	12.25	2.95	0.24	81.61
	Plumber						
	Welder						
Power Equipment Operators							
	*See per diem note on last page						
						L&M	
A1601	Group I, including:	53.23	12.10	16.25	1.05	0.10	82.73
	Asphalt Roller: Breakdown, Intermediate, and Finish						
	Back Filler						
	Barrier Machine (Zipper)						
	Beltcrete with Power Pack & similar conveyors						
	Bending Machine						
	Boat Coxswain						
	Bulldozer						
	Cableways, Highlines & Cablecars						
	Cleaning Machine						
	Coating Machine						
	Concrete Hydro Blaster						
	Cranes (45 tons & under or 150 feet of boom & under (including jib & attachments))						
	(a) Hydralifts or Transporters, (all track or truck type)						
	(b) Derricks						
	(c) Overhead						
	Crushers						
	Deck Winches, Double Drum						
	Ditching or Trenching Machine (16 inch or over)						
	Drag Scraper, Yarder, and similar types						
	Drilling Machines, Core, Cable, Rotary and Exploration						
	Finishing Machine Operator, Concrete Paving, Laser Screed, Sidewalk, Curb & Gutter Machine						
	Grade Checker and/or Line and Grade including Drone						
	Helicopters						
	Hover Craft, Flex Craft, Loadmaster, Air Cushion, All-Terrain Vehicle, Rollagon, Bargecable, Nodwell, & Snow Cat						
	Hydro Ax, Feller Buncher & similar						
	Hydro Excavation (Vac-Truck and Similar)						
	Loaders (2 1/2 yards through 5 yards, including all attachments):						
	(a) Forklifts (with telescopic boom & swing attachment)						
	(b) Front End & Overhead, (2-1/2 yards through 5 yards)						
	(c) Loaders, (with forks or pipe clamp)						
	(d) Loaders, (elevating belt type, Euclid & similar types)						

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Power Equipment Operators *See per diem note on last page							
A1601	Group I, including:	53.23	12.10	16.25	1.05	L&M 0.10	82.73
	Material Transfer Vehicle (Elevating Grader, Pickup Machine, and similar types)						
	Mechanic, Welder, Bodyman, Electrical, Camp & Maintenance Engineer						
	Micro Tunneling Machine						
	Mixers: Mobile type with hoist combination						
	Motor Patrol Grader						
	Mucking Machine: Mole, Tunnel Drill, Horizontal/Directional Drill Operator and/or Shield						
	Off-Road Hauler (including Articulating and Haul Trucks)						
	Operator on Dredges						
	Piledriver Engineer, L.B. Foster, Puller or similar paving breaker						
	Plant Operator (Asphalt & Concrete)						
	Power Plant, Turbine Operator 200 k.w & over (power plants or combination of power units over 300 k.w.)						
	Remote Controlled Equipment						
	Scraper (through 40 yards)						
	Service Oiler/Service Engineer						
	Shot Blast Machine						
	Shovels, Backhoes, Excavators with all attachments, and Gradealls (3 yards & under)						
	Sideboom (under 45 tons)						
	Sub Grader (Gurries & similar types)						
	Tack Tractor						
	Truck Mounted Concrete Pump, Conveyor/Tele-belt, & Creter						
	Wate Kote Machine						
A1602	Group IA, including:	55.33	12.10	16.25	1.05	L&M 0.10	84.83
	Camera/Tool/Video Operator (Slipline)						
	Certified Welder, Electrical Mechanic, Camp Maintenance Engineer, Mechanic (over 10,000 hours)						
	Cranes (over 45 tons or 150 feet including jib & attachments)						
	(a) Clamshells & Draglines (over 3 yards)						
	(b) Tower Cranes						
	Licensed Water/Waste Water Treatment Operator						
	Loaders (over 5 yards)						
	Motor Patrol Grader, Dozer, Grade Tractor (finish: when finishing to final grade and/or to hubs, or for asphalt)						
	Power Plants (1000 k.w. & over)						
	Profiler, Reclaimer, and Roto-Mill						
	Quad						
	Scrapers (over 40 yards)						

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Power Equipment Operators *See per diem note on last page							
						L&M	
A1602	Group IA, including:	55.33	12.10	16.25	1.05	0.10	84.83
	Screed						
	Shovels, Backhoes, Excavators with all attachments (over 3 yards)						
	Sidebooms (over 45 tons)						
	Slip Form Paver, C.M.I. & similar types						
	Topside (Asphalt Paver, Slurry machine, Spreaders, and similar types)						
						L&M	
A1603	Group II, including:	52.32	12.10	16.25	1.05	0.10	81.82
	Boiler - Fireman						
	Cement Hogs & Concrete Pump Operator						
	Conveyors (except those listed in Group I)						
	Hoists on Steel Erection, Towermobiles & Air Tuggers						
	Horizontal/Directional Drill Locator						
	Locomotives, Rod & Geared Engines						
	Mixers						
	Screening, Washing Plant						
	Sideboom (cradling rock drill, regardless of size)						
	Skidder						
	Trenching Machines (under 16 inches)						
	Water/Waste Water Treatment Operator						
						L&M	
A1604	Group III, including:	51.46	12.10	16.25	1.05	0.10	80.96
	"A" Frame Trucks, Deck Winches						
	Bombardier (tack or tow rig)						
	Boring Machine						
	Brooms, Power (sweeper, elevator, vacuum, or similar)						
	Bump Cutter						
	Compressor						
	Farm Tractor						
	Forklift, Industrial Type						
	Gin Truck or Winch Truck (with poles when used for hoisting)						
	Hoists, Air Tuggers, Elevators						
	Loaders:						
	(a) Elevating-Athey, Barber Greene & similar types						
	(b) Forklifts or Lumber Carrier (on construction job sites)						
	(c) Forklifts, (with tower)						
	(d) Overhead & Front End, (under 2-l/2 yards)						
	Locomotives: Dinkey (air, steam, gas & electric) Speeders						
	Mechanics, Light Duty						
	Oil, Blower Distribution						
	Posthole Digger, Mechanical						

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Power Equipment Operators							
	*See per diem note on last page						
						L&M	
A1604	Group III, including:	51.46	12.10	16.25	1.05	0.10	80.96
	Pot Fireman (power agitated)						
	Power Plant, Turbine Operator, (under 200 k.w.)						
	Pumps, Water						
	Roller (other than Asphalt)						
	Saws, Concrete						
	Skid Hustler						
	Skid Steer (with all attachments)						
	Stake Hopper						
	Straightening Machine						
	Tow Tractor						
						L&M	
A1605	Group IV, including:	44.06	12.10	16.25	1.05	0.10	73.56
	Crane Assistant Engineer/Rig Oiler						
	Drill Helper						
	Parts & Equipment Coordinator						
	Spotter						
	Steam Cleaner						
	Swamper (on trenching machines or shovel type equipment)						
Roofers							
	*See per diem note on last page						
						L&M	
A1701	Roofer & Waterproofer	52.07	13.90	4.01	0.81	0.10	0.09 70.98
						L&M	
A1702	Roofer Material Handler	38.68	13.90	4.01	0.81	0.10	0.09 57.59
Sheet Metal Workers, Region I (North of N63 latitude)							
	*See per diem note on last page						
						L&M	
N1801	Sheet Metal Journeyman	54.00	12.80	15.94	1.80	0.12	84.66
	Air Balancing and duct cleaning of HVAC & HVAC-R systems						
	Brazing, soldering or welding of metals						
	Demolition of sheet metal HVAC & HVAC-R systems						
	Fabrication and installation of exterior wall sheathing, siding, metal roofing, flashing, decking and architectural sheet metal work						
	Fabrication and installation of heating, ventilation and air conditioning ducts and equipment						
	Fabrication and installation of louvers and hoods						
	Fabrication and installation of sheet metal lagging						

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Sheet Metal Workers, Region I (North of N63 latitude) *See per diem note on last page							
						L&M	
N1801	Sheet Metal Journeyman	54.00	12.80	15.94	1.80	0.12	84.66

Fabrication and installation of stainless steel commercial or industrial food service equipment & wall sheathing

HVAC & HVAC-R Service Mechanic, servicing and maintaining and making operable HVAC & HVAC-R Systems

HVAC & HVAC-R systems controls and programming

Manufacture, fabrication assembly, installation and alteration of all ferrous and nonferrous metal work

Metal lavatory partitions

Preparation of drawings taken from architectural and engineering plans required for fabrication and erection of sheet metal work

Sheet Metal shelving, lockers

Sheet Metal venting, chimneys and breaching

Skylight installation

Sheet Metal Workers, Region II (South of N63 latitude) *See per diem note on last page							
						L&M	
S1801	Sheet Metal Journeyman	48.75	12.80	15.30	2.06	0.43	79.34

Air Balancing and duct cleaning of HVAC & HVAC-R systems

Brazing, soldering or welding of metals

Demolition of sheet metal HVAC & HVAC-R systems

Fabrication and installation of exterior wall sheathing, siding, metal roofing, flashing, decking and architectural sheet metal work

Fabrication and installation of heating, ventilation and air conditioning ducts and equipment

Fabrication and installation of louvers and hoods

Fabrication and installation of sheet metal lagging

Fabrication and installation of stainless steel commercial or industrial food service equipment & wall sheathing

HVAC & HVAC-R Service Mechanic, servicing and maintaining and making operable HVAC & HVAC-R Systems

HVAC & HVAC-R systems controls and programming

Manufacture, fabrication assembly, installation and alteration of all ferrous and nonferrous metal work

Metal lavatory partitions

Preparation of drawings taken from architectural and engineering plans required for fabrication and erection of sheet metal work

Sheet Metal shelving, lockers

Sheet Metal venting, chimneys and breaching

Skylight installation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Sprinkler Fitters	*See per diem note on last page						
A1901	Sprinkler Fitter	56.61	12.40	18.45	0.54	L&M 0.25	88.25
Surveyors	*See per diem note on last page						
A2001	Chief of Parties	59.93	13.48	14.64	1.30	L&M 0.10	89.45
A2002	Party Chief	55.78	13.48	14.64	1.30	L&M 0.10	85.30
A2003	Line & Grade Technician/Office Technician/GPS, Drones	52.77	13.48	14.64	1.30	L&M 0.10	82.29
A2004	Associate Party Chief (including Instrument Person & Head Chain Person)/Stake Hop/Grademan	50.31	13.48	14.64	1.30	L&M 0.10	79.83
A2006	Chain Person (for crews with more than 2 people)	45.29	13.48	14.64	1.30	L&M 0.10	74.81
Truck Drivers	*See per diem note on last page						
A2101	Group I, including:	51.58	13.48	14.64	1.30	L&M 0.10	81.10

Air/Sea Traffic Controllers
Ambulance/Fire Truck Driver (EMT certified)
Boat Coxswain
Captains & Pilots (air & water)
Deltas, Commanders, Rollagons, & similar equipment (when pulling sleds, trailers or similar equipment)
Dump Trucks (including articulating end dumps, rockbuggy, side dump, belly dump, & trucks with pups) over 40 yards up to & including 60 yards
Fueler
Helicopter Transporter
Liquid Vac Truck/Super Vac Truck
Material Coordinator or Purchasing Agent
Oil Distributor Truck
Ready-mix (over 12 yards up to & including 15 yards) (over 15 yards to be negotiated)
Semi with Double Box Mixer
Tireman, Medium Duty (Truck Tires up to 1200-24")
Water Wagon (250 Bbls and above)

A2102	Group 1A including:	53.05	13.48	14.64	1.30	L&M 0.10	82.57

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Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Truck Drivers	*See per diem note on last page						
						L&M	
A2102	Group 1A including:	53.05	13.48	14.64	1.30	0.10	82.57
	Dump Trucks (including rockbuggy, side dump, belly dump & trucks with pups) over 60 yards up to & including 100 yards (over 100 yards to be negotiated)						
	Jeeps (driver under load)						
	Lowboys, including tractor attached trailers & jeeps, up to & including 12 axles (over 12 axles or 150 tons to be negotiated)						
	Tireman Heavy Duty (earthmover tires, i.e., loader, scraper, haul truck)						
						L&M	
A2103	Group II, including:	50.12	13.48	14.64	1.30	0.10	79.64
	All Deltas, Commanders, Rollagons, & similar equipment						
	Batch Trucks (8 yards & up)						
	Batch Trucks (up to & including 7 yards)						
	Boom Truck/Knuckle Truck (over 5 tons)						
	Cacasco Truck/Heat Stress Truck						
	Construction and Material Safety Technician						
	Dump Trucks (including articulating end dump, rockbuggy, side dump, belly dump, & trucks with pups) over 20 yards up to & including 40 yards						
	Gin Pole Truck, Winch Truck, Wrecker (truck mounted "A" frame manufactured rating over 5 tons)						
	Mechanics						
	Partsman						
	Ready-mix (up to & including 12 yards)						
	Stringing Truck						
	Turn-O-Wagon or DW-10 (not self loading)						
						L&M	
A2104	Group III, including:	49.17	13.48	14.64	1.30	0.10	78.69
	Boom Truck/Knuckle Truck (up to & including 5 tons)						
	Dump Trucks (including articulating end dump, rockbuggy, side dump, belly dump, & trucks with pups) over 10 yards up to & including 20 yards						
	Expeditor (electrical & pipefitting materials)						
	Gin Pole Truck, Winch Truck, Wrecker (truck mounted "A" frame manufactured rating 5 tons & under)						
	Greaser - Shop						
	Semi or Truck & Trailer						
	Thermal Plastic Layout Technician						
	Traffic Control Technician						
	Trucks/Jeeps (push or pull)						
						L&M	
A2105	Group IV, including:	48.50	13.48	14.64	1.30	0.10	78.02
	Air Cushion or similar type vehicle						
	All Terrain Vehicle						

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Truck Drivers *See per diem note on last page							
						L&M	
A2105	Group IV, including:	48.50	13.48	14.64	1.30	0.10	78.02
	Buggymobile						
	Bull Lift & Fork Lift, Fork Lift with Power Boom & Swing Attachment (over 5 tons)						
	Bus Operator (over 30 passengers)						
	Cement Spreader, Dry						
	Combination Truck-Fuel & Grease						
	Compactor (when pulled by rubber tired equipment)						
	Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) up to & including 10 yards						
	Dumpster						
	Expeditor (general)						
	Fire Truck/Ambulance Driver						
	Flat Beds, Dual Rear Axle						
	Foam Distributor Truck Dual Axle						
	Front End Loader with Fork						
	Grease Truck						
	Hydro Seeder, Dual Axle						
	Hyster Operators (handling bulk aggregate)						
	Loadmaster (air & water operations)						
	Lumber Carrier						
	Ready-mix, (up to & including 7 yards)						
	Rigger (air/water/oilfield)						
	Tireman, Light Duty						
	Track Truck Equipment						
	Truck Vacuum Sweeper						
	Warehouseperson						
	Water Truck (Below 250 Bbls)						
	Water Truck (straight)						
	Water Wagon, Semi						
						L&M	
A2106	Group V, including:	47.62	13.48	14.64	1.30	0.10	77.14
	Buffer Truck						
	Bull Lifts & Fork Lifts, Fork Lifts with Power Boom & Swing Attachments (up to & including 5 tons)						
	Bus Operator (up to 30 passengers)						
	Farm Type Rubber Tired Tractor (when material handling or pulling wagons on a construction project)						
	Flat Beds, Single Rear Axle						
	Foam Distributor Truck Single Axle						
	Fuel Handler (station/bulk attendant)						
	Gear/Supply Truck						

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
Truck Drivers							
	*See per diem note on last page						
						L&M	
A2106	Group V, including:	47.62	13.48	14.64	1.30	0.10	77.14
	Gravel Spreader Box Operator on Truck						
	Hydro Seeder, Single Axle						
	Pickups (pilot cars & all light-duty vehicles)						
	Rigger						
	Swamper						
	Tack Truck (welders/gear)						
	Team Drivers (horses, mules, & similar equipment)						
Tunnel Workers, Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)							
	*See per diem note on last page						
						L&M	**LEG**
N2201	Group I, including:	44.28	10.55	21.51	2.00	0.35	0.20	78.89
	Brakeman						
	Mucker						
	Nipper						
	Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)						
	Topman & Bull Gang						
	Tunnel Track Laborer						
						L&M	**LEG**
N2202	Group II, including:	45.38	10.55	21.51	2.00	0.35	0.20	79.99
	Burning & Cutting Torch						
	Certified Erosion Sediment Control Lead (CESCL Laborer)						
	Concrete Laborer						
	Floor Preparation, Core Drilling						
	Jackhammer/Chipping Gun or Pavement Breaker						
	Laser Instrument Operator						
	Nozzlemen, Pumpcrete or Shotcrete						
	Pipelayer Helper						
						L&M	**LEG**
N2203	Group III, including:	46.37	10.55	21.51	2.00	0.35	0.20	80.98
	Miner						
	Retimberman						
						L&M	**LEG**
N2204	Group IIIA, including:	51.18	10.55	21.51	2.00	0.35	0.20	85.79
	Asphalt Raker, Asphalt Belly Dump Lay Down						
	Drill Doctor (in the field)						
	Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)						

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
						L&M	LEG	
Tunnel Workers, Laborers (The Alaska areas north of N63 latitude and east of W138 longitude) *See per diem note on last page								
N2204	Group IIIA, including:	51.18	10.55	21.51	2.00	0.35	0.20	85.79
	Pioneer Drilling & Drilling Off Tugger (all type drills) Pipelayer Powderman (Employee Possessor) Storm Water Pollution Protection Plan Specialist (SWPPP Specialist) Traffic Control Supervisor, DOT Qualified							
						L&M	LEG	
N2206	Group IIIB, including:	59.41	5.50	21.51	1.60	0.35	0.20	88.57
	Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours) Federal Powderman (Responsible Person in Charge) Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones) Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours) Stake Hopper							
Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude) *See per diem note on last page								
						L&M	LEG	
S2201	Group I, including:	44.28	10.55	21.51	2.00	0.35	0.20	78.89
	Brakeman Mucker Nipper Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer) Topman & Bull Gang Tunnel Track Laborer							
						L&M	LEG	
S2202	Group II, including:	45.38	10.55	21.51	2.00	0.35	0.20	79.99
	Burning & Cutting Torch Certified Erosion Sediment Control Lead (CESCL Laborer) Concrete Laborer Floor Preparation, Core Drilling Jackhammer/Chipping Gun or Pavement Breaker Laser Instrument Operator Nozzlemen, Pumpcrete or Shotcrete Pipelayer Helper							
						L&M	LEG	
S2203	Group III, including:	46.37	10.55	21.51	2.00	0.35	0.20	80.98
	Miner Retimberman							

Wage benefits key: ANU=Annuity, BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits		THR
Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude) *See per diem note on last page								
						L&M	**LEG**	
S2204	Group IIIA, including:	51.18	10.55	21.51	2.00	0.35	0.20	85.79
	Asphalt Raker, Asphalt Belly Dump Lay Down Drill Doctor (in the field) Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills) Pioneer Drilling & Drilling Off Tugger (all type drills) Pipelayer Powderman (Employee Possessor) Storm Water Pollution Protection Plan Specialist (SWPPP Specialist) Traffic Control Supervisor, DOT Qualified							
						L&M	**LEG**	
S2206	Group IIIB, including:	59.41	5.50	21.51	1.60	0.35	0.20	88.57
	Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours) Federal Powderman (Responsible Person in Charge) Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones) Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours) Stake Hopper							
Tunnel Workers, Power Equipment Operators *See per diem note on last page								
						L&M		
A2207	Group I	58.55	12.10	16.25	1.05	0.10		88.05
						L&M		
A2208	Group IA	60.86	12.10	16.25	1.05	0.10		90.36
						L&M		
A2209	Group II	57.55	12.10	16.25	1.05	0.10		87.05
						L&M		
A2210	Group III	56.60	12.10	16.25	1.05	0.10		86.10
						L&M		
A2211	Group IV	48.47	12.10	16.25	1.05	0.10		77.97

*** Per diem is an established practice for this classification. This means that per diem is an allowable alternative to board and lodging if all criteria are met. See 8 AAC 30.051-08 AAC 30.056, and the per diem information on page vii of this Pamphlet.**

**** Work in combination of classifications: Employees working in any combination of classifications within the diving crew (working diver, standby diver, and tender) in a shift are paid in the classification with the highest rate for a minimum of 8 hours per shift.**

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United States
Environmental Protection Agency

EPA Project Control Number

United States Environmental Protection Agency
Washington, DC 20460

Certification Regarding
Debarment, Suspension, and Other Responsibility Matters

The prospective participant certifies to the best of its knowledge and belief that it and the principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction: violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1) (b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated or cause or default.

I understand that a false statement on this certification may be ground for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both.

Typed Name & Title of Authorized Representative

Signature of Authorized Representative Date

☐ I am unable to certify to the above statements. My explanation is attached.

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Division of Water

State Revolving Fund Program

Equal Employment Opportunity Certification Form

This statement of acknowledgement is required by the Equal Employment Opportunity Regulations of the Secretary of Labor (41 CFR 60-l.7(b)(l)) and must be completed by each bidder and proposed subcontractor participating in this contract.

Bidders and proposed subcontractors with 50 or more employees and a federal contract amounting to $50,000 or more are required to submit one federal Employment Information Report (EEO-1) each year both conditions exist. To file EEO-1, also known as Standard Form 100, filers should access the web-based data collection application, the EEO-1 Component Online Filing System, on the Equal Employment Opportunity Commission website. A report is required to be filed within 30 days of the contract award if a report has not been filed in the preceding 12 months.

To certify compliance, please check the box that applies:

☐ I hereby state that the company is exempt from submitting EEO-1 this year.

☐ I hereby state that the company has submitted or intends to submit EEO-1 this year.

Reminder: Bidders and proposed subcontractors who file EEO-1 may also be required to file Form CC-257 Monthly Employment Utilization Report if the project has significant financial impact on a community, or the bidder/subcontractor has signed an agreement to do so. At a minimum, the bidder/subcontractor is required to maintain records which reflect the reporting requirements of CC-257.

Company Name:		**Address:**	
Project Name:			
Contract No.:		**Telephone No.:**	

Authorized Representative Signature	*Printed Name*	*Date*

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Disadvantaged Business Enterprise Compliance Statement

(Revised May 2025)

The purpose of the Disadvantaged Business Enterprise (DBE) program is to ensure nondiscrimination when awarding contracts and to help remove barriers for DBE participation under EPA financial assistance agreements. As such, federal regulations require that both loan recipients (borrowers) and prime contractors must undertake a good-faith effort as defined in40 CFR Part 33 Subpart C to award a fair share of work to DBEs who are minority business enterprises (MBEs)[1] and women's business enterprises (WBE's)[2].

In 2025, EPA suspended the negotiation of fair share objectives or goals for MBE/WBE participation. The Alaska Department of Transportation and Public Facilities and the Small Business Administration maintains a DBE Directory of certified DBE. An MBE/WBE can also be certified under the US Small Business Administration's 8(a) Business Development Program, the US Department of Transportation's (DOT) Participation by DBE in DOT Programs, an Indian Tribal Government, State Government, Local Government, or an independent private organization that certifies entities in accordance with EPA's 8% or 10% statutes as applicable. Self-certification of an MBE or WBE is prohibited.

Borrowers and Contractors - Good Faith Efforts

The following good faith efforts apply to the procurement of construction, equipment, services, and supplies with SRF financial assistance funds:

1. Ensure DBEs are fully made aware of contracting opportunities practicable through outreach and recruitment activities. For state and local government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For state and local government recipients, this will include dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take steps 1-5 above.

Both the borrower and the prime contractor are required to complete the Alaska SRF's *Disadvantaged Business Enterprise Program Good Faith Effort and Participation Form*. For all contractor/subcontractor

[1] To qualify as an MBE, an entity must be at least 51% owned by a socially or economically disadvantaged individual. See 40 CFR §33.202 and 13 CFR §124.105.
[2] In order to qualify as a WBE, an entity must be at least 51% owned by women. See 40 CFR §33.202 and 13 CFR §124.105.

bids submitted, the entity receiving the bids is required to keep a copy of the bid on file, along with the Good Faith Effort and Participation form, for no less than the records retention period specified in the borrower's loan agreement.

Borrowers Only – Additional Requirements

Include this form along with the *Disadvantaged Business Enterprise Program Good Faith Effort and Participation Form* in the bid and/or contract documents. Additionally, borrowers are required to semiannually report MBE and WBE participation in prime contracts and subcontracts through the Online Application System (OASys), the Alaska Department of Environmental Conservation web-based application for submitting loan and reporting documentation.

Contractors Only – Additional Requirements

Comply with the following (40 CFR Part 33, Appendix A):

> *The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.*

The prime contractor must pay its subcontractors no more than 30 days after receipt of payment from the borrower when satisfactory work has been performed. Additionally, the prime contractor is required to notify the borrower prior to any termination of a DBE subcontractor. If a subcontractor fails to perform the work under a subcontract, the prime contractor will employ the six Good Faith Efforts described above in seeking a replacement. The prime contractor must employ the six Good Faith Efforts even if the MBE and WBE goals have been met (also called the Fair Share Objectives).

The undersigned certifies that this recipient/contractor is aware that the above guidance is a summary of the requirements of EPA's Disadvantaged Business Enterprise regulations and is not all encompassing. Further, the undersigned certifies they will comply with all applicable federal regulations in 40 CFR Part 33. Failure to demonstrate a Good Faith Effort through solicitation of minority-owned businesses or women-owned businesses can result in ineligible expenses under the loan.

Print Name	Organization Name
Authorized Representative's Signature	**Date**

Clear Form

Disadvantaged Business Enterprise (DBE) Program
Good Faith Effort and Participation Form

This form is intended to capture an EPA financial assistance agreement recipient's[i] or sub-recipient's[ii] anticipated and actual use of certified DBEs. Alaska SRF recipients and prime contractor must complete this form and include it in the bid or proposal package when applicable. A copy of this form should be kept on file. Instructions:

Step 1. Please provide list of all DBEs that you solicited.

Option A. Provide pdf of all email solicitation to DBEs.
Option B. Fill contact information portion of table below for all DBEs solicited.

Step 2. For any DBE you intend to utilize, please provide the additional information for the contractor or subcontractor.

Project Name:				**Contract/Project Number:**		
Contract Amount:				**Organization Name:**		
Step 1: Contact Information				**Step 2: Utilization Information**		
Company Name	**Contact Phone/Email/Address**	**Responsive**	**Are you intending to hire this firm?**	**Description of Work**	**Contract Amount**	**MBE/ WBE**
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE

		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE
		No		Select Item		Non-DBE

		No		Select Item		Non-DBE
		No		Select Item		Non-DBE

Total Contract Amount of Utilized Companies ($)	$ 0.00

I certify under penalty of perjury that the forgoing information is true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of, that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Print Name:		**Organization Name:**
Authorized Representative's Signature:		**Date:**

[i] An entity that receives an EPA financial assistance agreement or is a sub-recipient of such agreement, including loan recipients under the Clean Water State Revolving Fund Program, Drinking Water State Revolving Fund Program, and the Brownfields Cleanup Revolving Loan Fund Program.

[ii] Borrowers of the SRF Program.

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Future work.
6. Owner-furnished products.
7. Access to site.
8. Coordination with occupants.
9. Work restrictions.
10. Specification and Drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 PROJECT INFORMATION

A. Project Identification: CBY Airport Water Extension.

1. Project Location: Yakutat, Alaska.

B. Owner: City & Borough of Yakutat.

1. Borough Manager: Jon Erickson.

C. Engineer: RESPEC Company LLC.

1.04 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. The work generally consists of, but is not limited to, construction of: extension of the water system to the airport of the City and Borough of Yakutat (CBY) that serves the Yakutat Lodge and Restaurant as a primary goal while also planning for future development along the route and fire flow as a secondary goal.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.05 WORK BY OWNER

A. The Owner will not be providing any work concurrent to this project.

1.06 OWNER-FURNISHED PRODUCTS

A. The Owner will not be furnishing any products for this project.

1.07 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project. The Project Site is within public rights-of-way as allowed by permits and public utility easements, in addition to City-owned land and buildings associated with the Work.

1.08 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1.09 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

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

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

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

1.03 DEFINITIONS

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

1.04 SCHEDULE OF VALUES

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

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

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Owner.
    c. Owner’s project number.
    d. Name of Engineer.
    e. Contractor's name and address.
    f. Date of submittal.

2. Arrange schedule of values consistent with format of EJCDC Document C-620.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

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

5. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
6. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
7. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
8. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
9. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.05 APPLICATIONS FOR PAYMENT

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

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

C. Application for Payment Forms: Use EJCDC Document C-620 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor shall be acceptable to Project Manager and Owner upon approval. Submit forms for approval with initial submittal of schedule of values.

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

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

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

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.

2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

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

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Project Manager by a method ensuring receipt within 24 hours.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

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

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

1. Schedule of values.
2. Contractor's construction schedule (preliminary if not final).
3. Products list (preliminary if not final).
4. Submittal schedule (preliminary if not final).
5. List of Contractor's staff assignments.
6. List of Contractor's principal consultants.
7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
8. Initial progress report.
9. Report of preconstruction conference.

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

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

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

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Evidence that claims have been settled.
5. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
6. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Request for information (RFIs).
4. Digital project management procedures.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Project Manager, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.04 INFORMATIONAL SUBMITTALS

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

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

B. Key Personnel Names: Within 5 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and cellular

telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, on Submittal Exchange. Keep list current at all times.

1.05 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

1.06 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form provided in the Contract Documents.

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

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

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

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

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

1. Attachments shall be electronic files in PDF format.

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

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

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

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

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.

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

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

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

1.07 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Engineer's Digital Data Files: Digital data files of Engineer's BIM model and CAD drawings will be provided by Engineer for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Autodesk Civil 3D 2024 and Autodesk Revit 2023.

B. PDF Document Preparation: Where PDFs are required to be submitted to Engineer, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.08 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times a minimum of 5 working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Project Manager, and Engineer, within three days of the meeting.

B. Preconstruction Conference: Project Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 10 days after execution of the Agreement.

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

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Designation of key personnel and their duties.
f. Lines of communications.
g. Use of web-based Project software.
h. Procedures for processing field decisions and Change Orders.

i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Sustainable design requirements.
o. Preparation of Record Documents.
p. Use of the premises and existing building.
q. Work restrictions.
r. Working hours.
s. Owner's occupancy requirements.
t. Responsibility for temporary facilities and controls.
u. Procedures for moisture and mold control.
v. Procedures for disruptions and shutdowns.
w. Construction waste management and recycling.
x. Parking availability.
y. Office, work, and storage areas.
z. Equipment deliveries and priorities.
aa. First aid.
bb. Security.
cc. Progress cleaning.

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

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer and Project Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Sustainable design requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility requirements.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
p. Compatibility of materials.

q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 10 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Project Manager, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for completing sustainable design documentation.
f. Requirements for preparing operations and maintenance data.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.
i. Preparation of Contractor's punch list.
j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
k. Submittal procedures.
l. Coordination of separate contracts.
m. Owner's partial occupancy requirements.
n. Installation of Owner's furniture, fixtures, and equipment.
o. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Engineer or Project Manager will conduct progress meetings at weekly intervals.

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

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

        1) Review schedule for next period.

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

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

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

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

5. During the project should the Owner raise concern on progress. The interval of these meetings may be increased as requested by Project Manager.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

REQUEST FOR INTERPRETATION (RFI)

PROJECT:	**CBY AIRPORT WATER EXTENSION**	**DCVR NO.**	C-1
CONTRACTOR:		**DATE SUBMITTED:**	
ORIGINATOR:			

Item:

Reference Drawing and/or Specification:

Description:

Response Requested By (Date):

Originator (Name/Firm):

Response to RFI:

Response by (Name/Firm): Date:

Owner's Comment / Direction to Contractor:

Response by (Name/Firm): Date:

This form is for clarification only. You must notify the Owner's Representative immediately if this RFI causes any changes to your contract price, schedule, or contract completion date. This RFI is not a notice to proceed with any changed condition.

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

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

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.

1.02 DEFINITIONS

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

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

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

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

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

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.03 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.
3. Two paper copies.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

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

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

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

F. Daily Construction Reports: Submit at daily intervals.

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

1.04 COORDINATION

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

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

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.

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

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

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
2. Procurement Activities: Include procurement process activities for any long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's and Owner's administrative procedures necessary for certification of Substantial Completion.
5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

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

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

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

1. Use Microsoft Project.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 10 days of date established for the Notice of Award.

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

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

2.03 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 10 days of date established for the Notice of Award. Outline significant construction activities. Include skeleton diagram for the remainder of the Work.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 10 days after date established for the Notice of Award.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Engineer's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Testing.
d. Punch list and final completion.
e. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.04 REPORTS

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

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. High and low temperatures and general weather conditions, including presence of rain or snow.
6. Accidents.
7. Meetings and significant decisions.
8. Unusual events.
9. Stoppages, delays, shortages, and losses.
10. Meter readings and similar recordings.
11. Emergency procedures.

12. Orders and requests of authorities having jurisdiction.
13. Change Orders received and implemented.
14. Work Change Directives received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial completions and occupancies.
18. Substantial Completions authorized.

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

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

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

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

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

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section Includes:

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

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
4. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
5. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's and Project Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

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

1.04 SUBMITTAL SCHEDULE

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the construction. List those submittals required to maintain

orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Engineer's and Project Manager's final release or approval.
    g. Scheduled dates for installation.
    h. Activity or event number.

1.05 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Engineer.
4. Name of Project Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Engineer.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer and Project Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

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

1.06 SUBMITTAL PROCEDURES

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

1. Upload submittals on PDC Sharefile under the appropriate Specification Section and email karen.brady@respec.com with notifications.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Engineer and Project Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 5 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 5 days for review of each resubmittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Engineer and to Engineer's consultants, allow 5 days for review of each submittal. Submittal will be returned to Engineer before being returned to Contractor.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

1.07 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

D. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

E. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.08 ENGINEER'S REVIEW

A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required, and return it.

1. Submittals by Web-Based Project Management Software: Engineer and Project Manager will indicate, on Project management software website, the appropriate action. Actions

taken by indication on Project management software website have the following meanings:

a. If a submittal is marked “No Exceptions Noted”, formal revision and resubmission will not be required.
b. If a submittal is marked “Exceptions as Noted”, the Engineer noted differences between the submitted product and the Contract requirements but no revision or resubmission will be required.
c. If a submittal is marked “Revise and Resubmit”, the Contractor shall revise the submittal and provide formal resubmission.
d. If a submittal is marked “Rejected”, it shall mean either that the proposed material or product does not satisfy the specification, the submittal is so incomplete that it cannot be reviewed, or is a substitution request that is not allowed.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

C. Owner reserves the right to withhold monies due to the Contractor to cover additional costs of the Engineers’ review beyond the first resubmittal.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

F. Engineer will return without review submittals received from sources other than Contractor.

G. Submittals not required by the Contract Documents will be returned by Engineer without action.

1.09 REVIEW BY CONTRACTOR

A. Submittals shall be carefully reviewed by an authorized representative of the Contractor prior to submission to the Engineer.

B. Each submittal shall be dated and signed by the Contractor as being correct and in strict conformance with the Contract Documents.

C. In the case of Shop Drawings, each sheet shall be so dated and signed.

D. Any deviations from the Contract Documents shall be noted on the transmittal sheet.

E. The Engineer will only review submittals that have been so verified by the Contractor.

F. Non-verified submittals will be returned to the Contractor without action taken by the Engineer, and any delays caused thereby shall be the total responsibility of the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, Project Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

E. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

F. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Engineer or Project Manager.

1.04 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.05 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Reports: Prepare and submit certified written reports and documents as specified.

1.06 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.

B. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

C. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.

D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into

compliance with standards of workmanship established by Contract requirements and approved mockups.

E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.07 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

1.08 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

D. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329 and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1.09 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

C. Testing Agency Responsibilities: Cooperate with Engineer, Project Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer, Project Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

D. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.

5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

F. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Engineer, Project Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Engineer.
4. Identification of testing agency or special inspector conducting test or inspection.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.01 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.

1.02 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ACI	American Concrete Institute	(248) 848-3700
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASME	ASME International	(800) 843-2763
ASTM	ASTM International (American Society for Testing and Materials International)	(610) 832-9500
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
CRSI	Concrete Reinforcing Steel Institute	(847) 517-1200
ECA	Electrical Components Association www.ec-central.org	(703)907-8024
EJCDC	Engineers Joint Contract Documents Committee http://content.asce.org/ejcdc/	(703) 295-6000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040

GSI	Geosynthetic Institute	(610) 522-8440
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NACE	(National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NFPA	NFPA www.nfpa.org	(800) 344-3555
NSF	National Sanitation Foundation International www.nsf.org	(734) 769-8010
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
UL	(Underwriters Laboratories) www.ul.com	(847) 272-8800

B. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

COE	U.S. Army Corps of Engineers www.usace.army.mil	
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-6257
EPA	Environmental Protection Agency	(202) 272-0167
FDA	U.S. Food and Drug Administration www.fda.gov	
NIST	National Institute of Standards and Technology	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
USDA	U.S. Department of Agriculture www.usda.gov	
USPS	Postal Service www.usps.com	(202) 268-2000

C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
FTMS	Federal Test Method Standard (See FS)	

D. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADEC	Alaska Department of Environmental Conservation http://www.dec.state.ak.us/	907-451-2105
ADOT&PF	Alaska Department of Transportation & Public Facilities http://www.dot.state.ak.us/	907-451-2206

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.03 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner, Engineer, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Contractor will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Contractor will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Contractor will pay electric-power-service use charges for electricity used by all entities for construction operations.

1.04 ACTION SUBMITTALS

A. Traffic Control Plan (TCP): Submit traffic control plan for entire project two weeks prior to the start of construction.

1.05 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of ADEC Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.06 QUALITY ASSURANCE

A. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.07 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

B. Plastic Safety Fencing: Use 4foot-high construction orange fence manufactured by one of the following companies, or an approved equal:

1. “Warning Barrier” by Tensar Earth Technologies, Inc., 5833 Glenridge Drive, Suite 200, Atlanta, Georgia, 30328. Phone (404) 214-5343
2. “Flexible Safety Fencing” by Carsonite, 1301 Hot Springs Road, Carson City, Nevada, 89706. Phone (800) 648-7974.
3. “Warning Barrier Fence” by Plastic Safety Systems, Inc., P.O. Box 20140, Cleveland, Ohio, 44120. Phone (800) 662-6338.

2.02 TEMPORARY FACILITIES

A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Engineer and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
1. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
2. Drinking water and toilet.
3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.03 TRAFFIC CONTROL DEVICES

A. Traffic Control Devices: All traffic control devices shall conform to the requirements of the “Manual of Uniform Traffic Control Devices” (MUTCD) with the Alaska Supplement and the applicable utility/excavation/construction permit.

PART 3 - EXECUTION

3.01 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with City, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water and Sewer Service: If connecting to CBY's existing facilities, clean and maintain service facilities in a condition acceptable to Utility. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel.

3.02 SUPPORT FACILITIES INSTALLATION

A. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including drainage ditches, culverts, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

B. Parking: Provide temporary parking areas for construction personnel.

C. Storm Drainage: Dispose of rainwater in lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

D. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

E. Lifts and Hoists: Provide facilities necessary for hoisting materials.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.03 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of ADEC Construction General Permit and requirements specified in Section 310000 "Erosion, Sediment and Pollution Control."

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements (including the MUTCD with Alaska Supplement and the plans) for erection of structurally

adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

3.04 TRAFFIC CONTROL

A. Traffic Controls: Provide temporary traffic controls. Include traffic control devices and warning signs for public traffic. Comply with this specification or the requirements of authorities having jurisdiction as required in the applicable utility/excavation/construction permit, whichever is more stringent.

B. General:

1. All traffic control devices and signs used on this project shall meet the requirements of the Alaska Traffic Manual Supplement (ATMS) to the MUTCD.
2. Contractor shall continuously monitor the site under the varying conditions of traffic volume, light, and weather to insure that traffic control measures are operating effectively and that all devices used are clearly visible, clean, and in good repair.
3. All traffic control devices shall be removed immediately when no longer needed.
4. Contractor shall store construction equipment, materials, and debris in such a manner as to present the least possible hazard for the traveling public.
5. Existing signs and markings which conflict with construction signing shall be covered or removed.
6. Parking lots and driveways adjacent to excavations shall be barricaded as necessary to protect the public.
7. All signs shall be constructed of high intensity sheeting.
8. All signs shall be securely mounted.
9. All barricades shall have an operable steady-burn light except for barricades used for channeling traffic.
10. Contractor shall provide flagmen to assist large truck turning movements as necessary.
11. The safety of the traveling public shall remain the sole responsibility of the Contractor. It is emphasized that this Traffic Control Plan represents the minimum desirable standards, and that additional protection must be provided when special complexities and hazards prevail.
12. Warning lights shall be used to mark channelizing devices. The first device in a taper shall have a Type “B” flashing light, the remaining Type “C” steady burn.
13. When “High Level Warning Device” is specified, it shall include a Type “B” high intensity flashing warning light, and shall meet MUTCD/Alaska Supplement specifications.
14. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the posted speed limit.
15. When a reduction in pavement width is involved, the channelization taper minimums specified in the MUTCD shall be used.
16. Contractor shall coordinate and adjust traffic control measures to be compatible with other construction in the area.
17. Two weeks prior to the preconstruction conference, the Contractor shall submit a detailed Traffic Control Plan to the Engineer for approval. This plan shall be specific to his schedule and construction methods. It shall include how he proposes to maintain safe traffic lanes throughout the Work and shall address critical crossings on an individual basis.

18. Contractor shall install advisory speed plates in conjunction with warning signs when directed by the Engineer. Except in emergencies, and advisory speed plate shall not be erected until the recommended speed has been determined by the Engineer.
19. Traffic control for lane closures shall follow MUTCD Figure TA-11.
20. Traffic control for work on or adjacent to shoulders shall follow MUTCD Figure TA-3.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, no later than Substantial Completion. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Traffic Control: Shall not be measured it is a lump sum item.

4.02 BASIS OF PAYMENT

A. Payment for traffic control bid item shall include furnishing all necessary material, personnel, equipment, transportation, and supplies to perform the work as shown and specified.

Pay Item Number	Pay Item	Pay Unit
015000-1	Traffic Control	Lump Sum

END OF SECTION

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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Starting and adjusting.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

1.05 QUALITY ASSURANCE

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

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 013100 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer and Project Manager promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Engineer and Project Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out ground improvements.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer and Project Manager.

3.04 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer and Project Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Protection: Protect in-place construction during cutting and patching to prevent damage.

C. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Asphalt: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

E. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove materials from adjacent finished surfaces.

3.07 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Mobilization: Shall not be measured it is a lump sum item.

B. Field Engineering: Shall not be measured it is a lump sum item.

4.02 BASIS OF PAYMENT

A. Payment for field engineering bid item shall include furnishing all necessary material, personnel, equipment, transportation, and supplies to perform the work as shown and specified.

Pay Item Number	Pay Item	Pay Unit
017300-1	Mobilization	Lump Sum
017300-2	Field Engineering	Lump Sum

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.03 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at final completion.

1.04 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.05 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit testing, adjusting, and balancing records.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Advise Owner of changeover in utility services.
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements.
9. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer and Project Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.06 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer and Project Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Owner and Project Manager.
d. Name of Engineer.
e. Name of Contractor.
f. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel electronic file. Engineer and Project Manager will return annotated file.
b. PDF electronic file. Engineer and Project Manager will return annotated file.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Leave Project clean and ready for occupancy.

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.03 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Engineer by email to Engineer. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.

1. Correct or revise each manual to comply with Engineer comments. Submit copies of each corrected manual within 15 days of receipt of Engineer comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.05 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.06 FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual to contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.

5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1.07 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.08 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.09 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.

1.03 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints in PDF electronic format.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

1.04 RECORD DRAWINGS

A. Record Drawings will be developed by the Engineer based on Contractor mark-ups.

1.05 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

1.06 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.07 MAINTENANCE OF RECORD DOCUMENTS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 018000 – AMERICAN IRON AND STEEL (AIS) AND BUILD AMERICA-BUY AMERICA (BABA) ACT

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for AIS and BABA.

1.03 DEFINITIONS

A. Iron and Steel Products: Products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

B. Steel: An alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements.

C. Construction Materials: Includes an article, material, or supply-other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand or gravel; or aggregate binding agents or additives-that is or consists primarily of:
   1. Non-ferrous metals;
   2. Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
   3. Glass (including optic glass)
   4. Lumber; or
   5. Drywall.

D. Domestic Preference: This term and condition implements the Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, including Build America, Buy America Act, Pub. L. No. 117-58, §§ 70901-52.
   1. None of the funds provided under this award may be used for a project for infrastructure unless:
      a. All iron and steel used in the project are produced in the United States. This means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
      b. All manufactured products used in the project are produced in the United States. This means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and
      c. All construction materials (excluding cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or

additives) are manufactured in the United States. All manufacturing processes for the construction material occurred in the United States.

2. This preference also requires that all iron and steel products used for a project for the construction alteration, maintenance or repair of a public water system or treatment work are produced in the United States except as provided below.
   a. Applying the requirement would be inconsistent with the public interest.
   b. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
   c. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

E. Domestic Content Procurement Preference: All iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

F. Infrastructure: Includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

G. Project: The construction, alteration, maintenance, or repair of infrastructure in the United States.

1.04 AMERICAN IRON AND STEEL (AIS)

A. AIS requirements apply to State Revolving Fund assistance agreements signed on or after January 17, 2014, including all treatment works projects funded by a CWSRF assistance agreement and all public water system projects funded by a DWSRF assistance agreement signed on or after January 17, 2014. Based on the FY 2023 Consolidated Appropriations Act directive Congressional language, AIS requirements apply to this project.

B. The Build America, Buy America (BAB) Act requirements do not supersede the AIS requirements, and both provisions still apply and work in conjunction. Compliance with AIS requirements meets the BABA requirements for iron and steel.

1.05 REQUEST FOR A WAIVER

A. Any recipient request to use foreign iron or steel products shall include adequate information for federal Government evaluation of the request, including.
   1. A description of the foreign and domestic iron, steel, and/or manufactured goods;
   2. Unit of measure;
   3. Quantity;
   4. Cost;
   5. Time of delivery or availability;
   6. Location of the project;
   7. Name and address of the proposed supplier; and
   8. A detailed justification of the reason for use of foreign iron or steel products cited.

B. If the Administrator receives a request for a waiver under this section, the waiver request shall be made available to the public for at least 15 days prior to making a finding based on the request.

C. Unless the Administrator issues a waiver of this term, use of foreign iron and steel products is noncompliant with P.L. 117-103 and the Explanatory Statement for Division G of P.L. 117-103.

D. This term and condition shall be applied in a manner consistent with United States obligations under international agreements.

1.06 BUILD AMERICA, BUY AMERICA (BABA) ACT

A. The Build America, Buy America Act is a law that applies a domestic content procurement preference requirement to Federally funded public "infrastructure projects".

B. The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

1.07 REQUEST FOR WAIVER

A. A request to waive the application of the domestic content procurement preference must be in writing and submitted following the waiver instruction at https://www.epa.gov/cwsrf/build-america-buy-america-baba .

B. Waiver requests are subject to review by the Office of Management and Budget's Made in America Office.

C. There may be instances where an award qualifies, in whole or in part, for an existing waiver described at https://www.epa.gov/cwsrf/build-america-buy-america-baba-approved-waivers .

D. The U.S. Environmental Protection Agency may grant a waiver based upon one of the exceptions as established in Section 70914(b) of the Infrastructure Investment and Jobs Act and further described in the Office of Management and Budget Memorandum M-22-11.

E. Any recipient waiver request to use foreign iron, steel, manufactured products, and/or construction materials in an infrastructure project shall include adequate information for the Federal Government evaluation of the request including:
1. The Federal Award Identification Number (FAIN);
2. Location and description of the project;
3. Total cost of infrastructure expenditures, including federal and non-federal funds;
4. List of iron or steel item(s), manufactured products, and construction material(s) proposed to be excepted from the Buy America requirements, including name, cost, country(ies) of origin (if known), relevant Product Services Code (PSC) and North American Industry Classification System (NAICS) code for each, unit of measure, quantity, time of delivery or availability, and name and address of the proposed supplier;

5. A detailed justification of the reason for use of foreign iron, steel, manufactured products, and/or construction materials;
6. Anticipated impact if no waiver is issued; and
7. A certification that the federal official or assistance recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with the prime contractor.

F. Unless a waiver applies, use of foreign iron, steel, manufactured products, and/or construction materials that are consumed in, incorporated into, or affixed to an infrastructure project is noncompliant with this term and condition pursuant to the Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, including Build America, Buy America Act, Pub. L. No. 117-58 §§ 70901-52.

G. Maintain documentation of any use of materials which are considered de minimis and are covered by an existing waiver (e.g. miscellaneous, generally low-cost products that are essential for construction and are incorporated into the physical structure of the Project) with grant project files for a period of three years from the date of submission of the final expenditure report, in accordance with 2 CFR 200.334.

H. If recipient seeks coverage under an existing BABA waiver, recipient agrees to submit available evidence to the EPA project officer to support such a determination as identified in the BABA waiver. Recipient shall maintain this evidence with grant project files for a period of three years from the date of submission of the final expenditure report, in accordance with 2 CFR 200.334.

END OF SECTION

SECTION 024119 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected site elements.
   2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

   1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction in a manner to prevent damage.

1.04 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   4. Review areas where existing construction is to remain and requires protection.

1.06 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

1.07 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.08 FIELD CONDITIONS

A. Storage or sale of removed items or materials on-site is not permitted.

B. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.09 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - EXECUTION

2.01 EXAMINATION

A. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

B. Survey of Existing Conditions: Record existing conditions by use of measured drawings.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

2.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Be Removed, Decommissioned, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Disconnect, demolish, and remove plumbing, equipment, and components indicated on Drawings to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

2.03 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

B. Remove temporary barricades and protections where hazards no longer exist.

2.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Do not use cutting torches until work area is cleared of flammable materials.
2. Maintain fire watch during and for at least 1 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Dispose of demolished items and materials promptly.

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

2.05 DISPOSAL OF DEMOLISHED MATERIALS

A. Burning: Do not burn demolished materials.

2.06 SELECTIVE DEMOLITION SCHEDULE

A. Selective Demolition.

PART 3 - MEASUREMENT AND PAYMENT

3.01 MEASUREMENT

A. Selective Demolition: Selective Demolition will not be measured since it is a lump sum item. This includes all items needed to be removed in order accomplish the work.

3.02 BASIS OF PAYMENT

A. Payment for Selective Demolition items by the Contractor shall include furnishing all necessary material, personnel, equipment, transportation, excavation, and backfill up to existing grade, and supplies to perform the work as shown and specified.

Pay Item No.	Pay Item	Pay Unit
024119-1	Selective Demolition	Lump Sum

END OF SECTION

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.

1.02 BUY AMERICAN REQUIREMENTS

1. Provide certificates to show that all products meet the following requirements.
   a. American Iron and Steel (AIS)
   b. Build America, Buy America Act

2. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

2.02 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

2.03 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

3.02 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. 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.

3.03 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.

3.04 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.05 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.06 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel-reinforcement placement.

END OF SECTION 032000

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Admixtures.
4. Vapor retarders.
5. Floor and slab treatments.
6. Liquid floor treatments.
7. Curing materials.
8. Accessories.
9. Repair materials.
10. Concrete mixture materials.
11. Concrete mixture class types.
12. Concrete mixing.

B. Related Requirements:

1. Section 032000 "Concrete Reinforcing" for steel reinforcing bars.

1.02 BUY AMERICAN REQUIREMENTS

1. Provide certificates to show that all products meet the following requirements.
   a. American Iron and Steel (AIS)
   b. Build America, Buy America Act

2. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product data.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Compressive strength at 28 days or other age as specified.
3. Durability exposure classes for Exposure Categories F, S, W, and C.
4. Maximum w/cm ratio.
5. Slump or slump flow limit.
6. Air content.
7. Nominal maximum aggregate size.

8. Intended placement method.
9. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1.04 INFORMATIONAL SUBMITTALS

A. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.

B. Material certificates.

C. Material test reports.

D. Preconstruction test reports.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

A. Ready-Mixed Concrete 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 in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-Certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.

1. Post-Installed Concrete Anchors Installers: ACI-Certified Adhesive Anchor Installer.

C. Owner’s Engineer shall be responsible for the design of the anchor rod embedment securing the columns of the pre-engineered metal building (PEMB) system to the foundation. Some modification to the mat foundation may be required should the foundation reactions be larger than anticipated or configured different than shown on the drawings. This may include increase or change in concrete member sizes along with additional reinforcing. There will be no compensation to the Contractor for these modifications to the foundation elements, up to an additional 10% total volume of concrete and total weight of reinforcing steel, nor shall the Contractor be required to pay for any additional engineering services performed by the Owner’s Engineer associated with these changes to the foundation system due to reactions at support

columns and associated lateral bracing being larger than anticipated. Anchor rod design shall comply with provisions of ACI 318.

D. Owner's Engineer shall not be required to pay for a full foundation redesign should the pre-engineered metal building manufacturer use a different system, layout, or framing than specified herein.

E. The foundation design shown on Contract Drawings is suitable for typical metal building of size and configuration specified herein. Should the foundation require modifications to adapt to the Contractor's proposed metal building, all changes to the concrete foundation system shall be the responsibility of the Contractor at no additional cost to the Owner, up to an additional 10% total volume of concrete and total weight of reinforcing steel. A full submittal of all proposed changes shall be provided for review and approved including detailed drawings.

F. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties on behalf of the Architect/Engineer.

G. Field Quality-Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.07 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

2. 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.

3. Maintain concrete above 50 degrees Fahrenheit and in a moist condition for a minimum of seven days after placement with tenting or other acceptable enclosures.

4. Do not use frozen materials or materials containing ice or snow.

5. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.

6. 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 at time of discharge to not exceed 95 deg F.

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

2.01 CONCRETE STANDARDS

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.02 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/Type II, Type IL.

B. Normal-Weight Aggregates:

1. Coarse Aggregate: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.
2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
3. Fine Aggregate: ASTM C33/C33M.

2.03 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

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.
7. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.

C. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M.

2.04 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended thickness and adhesive or pressure-sensitive tape.

2.05 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.06 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F (10 deg C): Black.
b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

C. Curing Paper: 8 ft. wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

D. Water: Potable water that does not cause staining of the surface.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B**.**

G. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.07 ACCESSORIES

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Floor Slab Protective Covering: 8 ft. wide cellulose fabric.

2.08 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.

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.

2.09 CONCRETE MIXTURE MATERIALS

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, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use 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, and concrete with a w/cm below 0.50.

2.10 CONCRETE MIXTURE CLASS TYPES

A. Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: ACI 318, as indicated on drawings.
2. Minimum Compressive Strength: as indicated on drawings.
3. Maximum w/cm Ratio: as indicated on drawings.
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 at Project site.
5. Air Content:
    a. Exposure Classes F2 and F3: as indicated on drawings, at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 TOLERANCES

A. Comply with ACI 117.

3.03 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

3.04 INSTALLATION OF VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.05 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

B. Notify testing and inspection agencies 48 hours prior to commencement of concrete placement.

C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.

D. 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.

E. 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.

3.06 INSTALLATION OF JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control 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 cracks.

D. Isolation Joints in Slabs-on-Ground: 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 on Drawings.

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 079200 "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:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.07 APPLICATION OF FINISHING FLOORS AND SLABS

A. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

a. Slabs on Ground:
1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding 10-ft-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.08 APPLICATION OF FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
b. Remove projections larger than 1 inch.
c. Tie holes do not require patching.
d. Surface Tolerance: ACI 117, Class D.
e. Apply to concrete surfaces for metal lap pan deck formed surfaces and those surfaces that are buried or covered with subsequent installed surfaces.

3.09 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling in:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
3. 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 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 as indicated on Drawings.
3. Minimum Compressive Strength: As indicated on Drawings .

3.10 APPLICATION OF CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305R, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        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.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:

            a) Water.
            b) Continuous water-fog spray.

    b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        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.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors To Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer**.**

d. Floors To Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface has received a float finish or abrasive surface preparation.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.12 INSTALLATION OF JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

3.13 INSTALLATION OF CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Engineer.
2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.

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 in excess of 0.01 inch spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, 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.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. 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.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and match surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Engineer.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including 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.
3. After concrete has cured at least 14 days, correct high areas by grinding.

4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer’s approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer’s approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
2. Testing agency to immediately report to Engineer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Engineer, Contractor, and concrete manufacturer within 72 hours of inspections and tests.

C. Delivery Tickets: Comply with ASTM C94/C94M.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with 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 150 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

    a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests as needed.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.

    a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

a. 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 when strength test specimens are cast.

5. Concrete Density: ASTM C138/C138M:

   a. One test for each composite sample when strength test specimens are cast.

6. Compression Test Specimens: ASTM C31/C31M:

   a. Cast and standard cure two sets of two 6 inches by 12-inches or 4-inch by 8-inch cylindrical specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of two standard cured specimens at seven days and one set of two specimens at 28 days.
   b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.

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:

    a. Testing and inspecting agency to 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.
    b. 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.

       1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.7.6.3.

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.

3.15 PROTECTION

A. Protect concrete surfaces.

B. Protect from petroleum stains.

C. Prohibit vehicles from interior concrete slabs.

D. Prohibit placement of steel items on concrete surfaces.

END OF SECTION

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. This Section includes the following:

1. Miscellaneous steel framing and supports.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts and other items cast into concrete.

1.04 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

B. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Equipment supports

C. Delegated Design Submittals: For ladders, stairs, platforms and equipment supports, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Research Reports: For post-installed anchors.

D. Delegated design engineer qualifications.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders, stairs, platforms, and equipment supports.

2.03 METALS, GENERAL

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.

2.04 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Steel Tubing: A500 Grade C.

C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.05 FASTENERS

A. General: Unless otherwise indicated, provide stainless-steel fasteners for interior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior locations. Select fasteners for type, grade, and class required.

B. Cast-in-Place Anchors in Concrete with exposed parts in interior locations: Threaded type 304, type 316 stainless steel, or hot-dipped galvanized. Provide bolts, washers, and shims as needed, with nuts meeting requirements of ASTM F 594 and washers of ANSI B18.22.1, Type A, plain.

C. Post-Installed Anchors for interior locations: Torque-controlled expansion anchors.

1. Material: stainless steel components to comply with type 304 or type 316 stainless steel, unless otherwise indicated.

D. Steel Bolts and Nuts: Regular hexagon-head bolts, with hex nuts, and, where indicated, flat washers.

E. Plain Washers: Round.

F. Lock Washers: Helical, spring type.

2.06 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

B. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete (Limited Applications)" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 4,500 psi, unless otherwise indicated.

2.07 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. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. There will be no change orders given for the miscellaneous framing and supports required for mechanical and electrical equipment or architectural features specified elsewhere in the Contract Documents. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate all framing and structural members required to support any mechanical and electrical equipment specified elsewhere in the Contract Documents as well as framing

for support and bracing of all architectural features. This includes any bracing of equipment or features to resist lateral seismic loads.

2. Fabricate steel girders for wood frame construction from continuous steel shapes. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches o.c.
3. Fabricate steel pipe columns for supporting wood frame construction with steel baseplates and top plates welded to pipe with fillet welds the same size as pipe wall thickness unless noted otherwise.

C. 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.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. 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.

G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

H. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

I. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

J. 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.

K. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.

L. Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Exterior Miscellaneous Steel Trim: Galvanize.

2.08 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.09 STEEL AND IRON FINISHES

A. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 099123 "Interior Painting".

B. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. 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.

D. Stripe paint corners, crevices, bolts, welds, and sharp edges

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize exterior miscellaneous steel trim.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with non-shrink, nonmetallic grout.

C. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Clean and touchup painting of field welds, bolted connections, and abraded areas with shop paint are specified in Section 099123 “Interior Painting”.

END OF SECTION 055000

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Spray-in-place rigid closed cell 2-pound polyurethane foam insulation in various assemblies, to provide an air barrier and improved thermal resistance

1.2 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. Build America, Buy America Act

1.3 ACTION SUBMITTALS

A. Product Data:

1. Closed-cell spray polyurethane foam.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM D1622, minimum density of 2-22.5 lb/cu. ft. and minimum R-value at 1-inch thickness of R-7.4.

1. Acceptable Manufacturer:
   a. Huntsman Building Solutions, Icynene HFO 200.
   b. Henkel Loctite Tite foam Gaps & Cracks
   c. Sika corporation Sika Boom
2. Requests for substituions as judged by Architect in accordance with provisions of section 013300.
3. Surface-Burning Characteristics: Comply with ASTM E84, class 1; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 400or less.

4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

END OF SECTION 072119

SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Snow guard system for standing seam insulated metal roofing.

1.2 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

1.3 REFERENCES

A. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. SMACNA Architectural Sheet Metal Manual.

D. Manufacturer’s installation guidelines and recommendations.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical data, installation instructions, and maintenance requirements.

B. Shop Drawings: Indicate layout, placement, and attachment details.

C. Samples: Manufacturer’s standard color and finish samples.

D. Warranty: Manufacturer’s standard warranty for snow guard system.

1.5 QUALITY ASSURANCE

A. Minimum of five years of experience in manufacturing snow guard systems.

B. Installer Qualifications: Minimum of three years of experience in installing similar systems.

C. Mock-Up: Provide a mock-up to demonstrate attachment method and appearance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original packaging.

PART 2 - Store materials in a dry location, elevated off ground, and protected from moisture and damagePRODUCTS

2.1 SYSTEM DESCRIPTION

A. Snow retention system designed to prevent sliding snow and ice from falling off roof surfaces and to evenly distribute snow loads across the roof.

B. System shall be non-penetrating and clamp-mounted to standing seam panels.

C. System shall be compatible with the profile and spacing of CFR insulated metal roof panels by Metl-Span.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Snow guard system shall be capable of withstanding snow loads calculated in accordance with ASCE 7, as applicable to project location in Yakutat, Alaska.

B. Thermal Movement: Accommodate thermal movement of roof panel system without compromising performance or causing damage to roofing.

C. Corrosion Resistance: Materials shall be non-corrosive or coated to resist corrosion in coastal and high-humidity environments.

D. Load Testing: Provide evidence of product testing for shear and tensile strength capacities of clamp attachments to standing seam panels.

2.3 Snow Guards:

1. Two-pipe aluminum snow retention system.

2. Non-penetrating attachment for standing seam insulated metal roofing.

3. Clamp-on system designed for CFR by Metl-Span panels.

B. Accessories:

1. Fasteners and clamps as recommended by manufacturer.

2. Color-matched finish for visibility reduction, if required.

2.4 FINISHES

A. Mill finish aluminum or powder-coated finish as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify roof panel conditions are suitable for installation. B. Report any deficiencies to Architect before proceeding.

3.2 INSTALLATION

A. Install snow guards according to manufacturer's written instructions.

B. Position and attach units to roof panel seams without penetrating the panel.

C. Secure clamps and pipes to ensure uniform alignment and structural integrity.

D. Inspect completed installation for proper attachment and performance

3.3 CLEANING AND PROTECTION

A. Remove any debris or materials from roof after installation.

B. Protect installed snow guards from damage until final acceptance.

END OF SECTION 077253

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetration firestopping systems.
2. Penetrations in fire-resistance-rated walls.
3. Exposed penetration firestopping systems.

1.2 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

1.3 ACTION SUBMITTALS

A. Product data.

1.4 INFORMATIONAL SUBMITTALS

A. Listed system designs.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Entity that has received UL's "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Provide rated systems complying with the following requirements:

      a. Penetration firestop systems installed with products bearing the classification marking of a qualified testing agency.

         1) UL in its online directory "Product iQ."
         2) FM Approvals in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems are to be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

   1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
   2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.
   3. M-Rating: Provide penetration firestopping systems meeting specified F-Rating after being tested in accordance with ASTM E3037.

C. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined in accordance with UL 1479.

   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
   2. M-Rating: Provide penetration firestopping systems meeting specified L-Rating after being tested in accordance with ASTM E3037.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 723.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Polysulfide joint sealants.
4. Acoustic joint sealant.

B. Related Section includes:

1. Division 09 Section “Gypsum Board” for acoustic joint sealant at top and bottom of interior walls.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

1.03 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

1.04 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.

2.02 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.

B. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.

2.03 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.04 URETH ANE JOINT SEALANTS

Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.

2.05 MILDEW-RESISTANT JOINT SEALANTS

A. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.06 ACOUSTIC JOINT SEALANT

A. Acoustical Joint 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. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.07 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330Type B (bicellular material with a surface skin). and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

PART 3 - EXECUTION

3.01 GENERAL

A. Material Installation:

1. Install all materials in accordance with the manufacturer’s recommendations or requirements.

3.02 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

B. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.04 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

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.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants 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.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Joints between different materials listed above.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 25, T, NT.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.

2. Joint Sealant: Urethane, S, P, 25, T, NT.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.

F. Joint-Sealant Application: Interior penetrations in floor assemblies above or below rooms that are acoustically enclosed or separated from adjoining spaces.

1. Joint Locations:

a. Floor penetrations.

2. Joint Sealant: Acoustic joint sealant.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Standard hollow metal doors and frames.

1.03 RELATED DEFINITIONS ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:

C. Other Action Submittals:

   1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.06 INFORMATIONALQUALITY ASSURANCE

A. 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 as close to neutral pressure as possible according to NFPA 252.

1.08 450 deg FDELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

   1. Provide additional protection to prevent damage to finish of factory-finished units.

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.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.10 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.

1.11 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 - PRODUCTS

A. MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amweld Building Products, LLC.
b. Ceco Door Products; an Assa Abloy Group company.
c. Curries Company; an Assa Abloy Group company.
d. Kewanee Corporation (The).
e. Pioneer Industries, Inc.
f. Steelcraft; an Ingersoll-Rand company.
g. Windsor Republic Doors.

2.02 MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

B. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.03 STANDARD HOLLOW METAL DOORS

A. General: Provide 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/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Vertical Edges for Single-Acting Doors: Square edge.
4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Exterior Thermal-Rated (Insulated) Doors: Provide exterior doors fabricated with thermal-resistance value (R-value) of not less than 12.3 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
2. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

    a. Thickness: 1-3/4 inches.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Insulated Frames: Match insulation for exterior doors.
2. Fabricate frames as full profile knock down unless otherwise indicated.
3. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames as full profile knock down unless otherwise indicated.
2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.
3. Frames for Wood Doors: 0.067-inch-thick steel sheet.
4. Frames for Borrowed Lights: 0.067-inch-thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

2.06 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.07 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. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

D. Hollow Metal Frames: 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.

1. Exterior Frames: Fabricate frames as full profile welded unless otherwise indicated.
2. Interior Frames: Fabricate frames as full profile welded unless otherwise indicated.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. 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.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated 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. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

G. Steel Frames:

1. Sheet steel, metal thickness as appropriate to maintain STC and fire ratings.
2. Factory assembled, mitered corners, fully welded frames.
3. Affix permanent metal nameplates to frame, indicating manufacturer's name, STC rating, and fire rating.
4. Frames to be grouted.

2.08 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.01 GENERAL

A. Material Installation:

1. Install all materials in accordance with the manufacturer’s recommendations or requirements.

3.02 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. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 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 to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.04 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 ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    b. Check plumbness, squareness, and twist of frames as walls are constructed. 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 postinstalled expansion anchors.
3. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

    a. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.05 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. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board sheathing.
3. Tile backing panels.
4. Acoustic joint sealant.

B. Related Requirements:

1. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.

C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch.

2.02 EXTERIOR GYPSUM BOARD SHEATHING

A. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.

2.03 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Reveal at wall of Denali Wall graphics:

1. Provide Architectural reveal bead: Trim-Tex, Drywall products, 1/2-inch deep.

a. Approved equal.

2.04 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

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.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

PART 3 - EXECUTION

3.01 GENERAL

A. Material Installation:

1. Install all materials in accordance with the manufacturer’s recommendations or requirements.

3.02 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 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 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. Fit gypsum panels around ducts, pipes, and conduits.
2. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8 inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2 inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.04 APPLYING INTERIOR GYPSUM BOARD

A. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

3.05 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 at locations indicated on Drawings.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use where indicated.
6. Curved-Edge Cornerbead: Use at curved openings.

3.06 FINISHING GYPSUM BOARD

A. 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 4: At panel surfaces that will be exposed to view unless otherwise indicated.

END OF SECTION

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.
   1. Steel.
   2. Wood.
   3. Gypsum board.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

PART 2 - PRODUCTS

2.01 PAINT, GENERAL

A. Basis-of-Design Product: Subject to compliance to requirements, provide products by Sherwin-Williams, or a comparable product by one of the following:
   1. Benjamin-Moore.
   2. PPG Architectural Coatings Inc.
   3. Devoe Coatings.
   4. Preapproved equal.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Dry-Fog Coatings: 400 g/L.
   4. Primers, Sealers, and Undercoaters: 200 g/L.
   5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Floor Coatings: 100 g/L.

C. Colors: As indicated in a color schedule.

PART 3 - PRODUCTS

3.01 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. Wood: 15 percent.
   2. Gypsum Board: 12 percent.
   3. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates 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.

D. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. 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.

3.04 CLEANING AND PROTECTION

A. 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 ENGINEER's Consultant, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.05 INTERIOR PAINTING SCHEDULE

A. Low VOC, Alkyd Enamel Paint: Locations as indicated.
   1. Prime Coat: Sherwin Williams, primer suitable for substrate and topcoat.
   2. Intermediate Coat: Matching topcoat.
   3. Topcoat: Sherwin Williams, ProMar® 200, Interior Waterbased Acrylic-Alkyd, Eg-Shel.

B. Concrete Sealer for Concrete Floors where indicated by the Room Finish Schedule:

C. Non-structural Steel Substrates: Includes, but not limited to, metal ladders, metal stairs and handrails, metal doors, metal door frames, metal lite frames, metal access doors and frames regardless of locations, and electrical panels in normally occupied rooms. For hollow metal exterior doors and frames see Division 09 Section "Exterior Painting".
   1. Shop Prime Coat: Manufacturer's standard.
   2. Field Prime Coat: Sherwin Williams, Kem Kromik® Universal Metal Primer.
   3. Intermediate Coat: Matching topcoat.
   4. Topcoat: Sherwin Williams, Pro Industrial Multi-Surface Acrylic Eg-Shel.

D. Structural Steel Substrates, Exposed.
   1. Field Prime Coat: Sherwin Williams, Pro-Cryl®, Universal Primer, B66-310 Series.
   2. Intermediate Coat: Matching topcoat.
   3. Topcoat: Sherwin Williams, Pro Industrial Multi-Surface Acrylic, B66-xxx Series, Eg-Shel.

E. Gypsum Board Substrates: Walls.
   1. Prime Coat: Sherwin Williams, ProMar® 200 Primer.
   2. Intermediate Coat: Matching topcoat.
   3. Topcoat: Sherwin Williams, ProMar® 200 Zero VOC Interior Latex Semi-Gloss.

3.06 INTERIOR PAINT COLOR SCHEDULE

A. As selected by owner.

END OF SECTION

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SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

1. Structural-steel framing.
2. Foam Insulated Metal Wall Panels and Trim
3. Foam Insulated Metal Roof Panels and Trim
4. Wall girts
5. Roof purlins
6. Lateral bracing
7. Anchor rods
8. Accessories

B. The CONTRACTOR shall coordinate the Metal Building design with all trades and installations included in the Contract Documents. This includes, but is not limited to the application of loads; fit and function between building and other components; and required clearances for equipment operation and intended occupant use.

C. Related Requirements:
1. Section 03 30 00 – Cast-in-Place Concrete.

1.03 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.04 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 “Cast-in-Place Concrete.”

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and attachments to other work.

1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal budling to foundation. Indicate column reactions at each location.

2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field- assembled work; show locations of exposed fasteners.

   a. Show roof-mounted items including roof hatches, equipment supports, pipe supports, and penetrations, light fixtures, and items mounted on roof curbs.
   b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and light fixtures.

4. Buy America Compliance Letter of Certification.

C. Samples: For units with factory-applied finishes. For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Delegated Design Submittals: For metal building systems.

1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer licensed in the State of Alaska, responsible for their preparation.

2. Provide calculations for the full building structural system including foundation reactions.

1.06 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Qualification Data: For erector and manufacturer.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Material test reports.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample warranties.

H. Erector certificates: for qualified erector, from manufacturer.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. As-Built Drawings: As-built conditions shall be updated on shop drawings and submitted after Substantial Completion. All revisions shall be drafted and the drawings labeled “As-Built” and signed by the CONTRACTOR.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Accreditation: Manufacturer's facility accredited according to IAS AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."

2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer approved under an accredited third-party quality control program

E. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum ten years' experience in the manufacturing of similar foam insulated metal panel products and successful use in similar applications

F. Installer Qualifications: Experienced foam insulation metal panel installer certified by metal panel manufacturer with minimum of five years' experience with successfully completed projects of a similar nature and scope.
1. Installer's Field Supervisor: Experienced mechanic [certified by metal panel manufacturer] supervising work on site whenever work is underway.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect foam-plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements:
   1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
   2. Established Dimensions for Metal Panels: Coordinate framing and opening dimensions with approved metal wall and roof panel shop drawings. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.11 WARRANTY

A. Special Weathertightness Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal building system components that fail to remain weathertight, including leaks, within 20 years from date of Substantial Completion.

B. Roof and Wall Paint Finish Warranty
   1. Paint Systems
      a. Furnish manufacturer's standard warranty for the metal panel paint system against chipping, peeling, blistering, fading in excess of 5 NBS Hunter units as set forth in ASTM-D-2244, and chalking in excess of 8 units as set forth in ASTM-D-4214.
      b. The warranty shall be for a period of 30 years from the date of substantial completion for PVDF paint systems.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Butler Manufacturing Company, a BlueScope Steel company.
   2. Garco Building Systems: Division of NCI Building Systems, L.P.
   3. Nucor Building Systems.
   4. Star Building Systems; an NCI company.
   5. VP Buildings; a United Dominion company.

B. Source Limitations: Obtain metal building system components, including primary and secondary framing from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Primary-Frame Type:
1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing
1. Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and flush-framed or exterior-framed (bypass) girts as indicated on the drawings.

E. Eave Height: As indicated by nominal height on Drawings.

F. Bay Spacing: As indicated on Drawings.

G. Roof Slope: As indicated on Drawings.

H. Foam Insulated Metal Panels
1. Labeling: Labeled through [a nationally recognized program] [FM Global], identifying the manufacturer, product name and model and product listings required in this section.
2. Panel Core: Foamed in-place, Zero Ozone Depletion Potential polyurethane or polyisocyanurate.
3. Fire Resistance:
   a. FM 4880 Class 1 Approval with no height restrictions.
   b. Flame Spread and Smoke Developed Index: The Flame Spread Index shall not exceed 25 and the Smoke Developed Index shall not exceed 450 when tested to ASTM E 84.

4. Panel Strength: Determine and certify panel allowable strengths as follows:
   a. Positive Loading (Toward Panel Supports): Determine in accordance with ASTM E 72.
   b. Negative Loading (Away from Panel Supports): Determine in accordance with ASTM E 1592.

5. U-Factor Determination: ASTM C 1363 conducted in accordance with ASHRAE 90.1 Section A9.3.2 or by Finite Element Modeling per ASHRAE 90.1 Section A9.4 and using core insulation thermal conductivity (k-factor) determined using ASTM C 518 conducted at 75 degree F mean temperature in the calculation.

I. Roof System: Standing Seam Insulated Roof Panels:
1. Panel profile Basis of Design: Metl-Span CFR-Insulated Roof Panel. A mechanically seamed vertical rib standing seam roof sandwich panel with concealed clips. Installed directly over purlin. Tested in accordance with ASTM E 1646 and E 1680 for water penetration and air infiltration, and per ASTM E1592 for wind uplift capacity
2. Panel thickness: 5 inches (U-.029 maximum)

3. Panel Width: 36 inches.
4. Exterior Face:

    a. Profile: Stucco embossed 1/8" (3.2mm) Mesa symmetrical ribs nominally 4 inches (10mm) on centers with 2" vertical leg standing seam side laps.
    b. Sheet Thickness: 24 gauge
    c. Finish: PVDF.
    d. Color: Selected from manufacturer standard colors.

5. Interior Face:

    a. Profile: Stucco embossed 1/8" (3.2mm) Mesa symmetrical ribs nominally 4 inches (10mm) on centers.
    b. Sheet Thickness: 24 gauge
    c. Finish: PVDF
    d. Color: Selected from manufacturer standard colors.
6. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
7. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf (955 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.

J. Exterior Wall System: Concealed Fastener Insulated metal panels conforming to ASTM A 792.
1. Panel Profile Basis of Design: Metl-Span: CF Mesa. A through fastened wall sandwich panel with concealed fasteners
    a. Panel thickness: 2.5 (U-050 maximum)
    b. Panel width: 36”
    c. Exterior Face Color: Selected from manufacturer standard colors.
    d. Interior Face Color: Selected from manufacturer standard colors.
2. Finishes:
    a. Exterior Paint: Fluoropolymer Two-Coat System (PVDF): 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat. Basis of Design: Signature 300.
    b. Interior Paint: 0.5 mil total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.

K. Fasteners:

1. Through-fastened panels: Self-drilling with sealing washer.
2. Standing seam panels: Long life self-drilling with sealing washer.
3. Ridge: Long-life self-drilling with sealing washer.
4. Clips to purlin or bar joists: Long-life self-drilling with hex washer head and washer.

L. Clips:

1. Low or high fixed clips: Use where moderate thermal expansion and contraction in roof panel is expected.
2. Low or high sliding clips: Provide 2 to 4 inches of travel for panel thermal expansion and contraction.

M. Sealants and closures:

1. Side-laps: Factory applied, hot melt, foamable mastic.
2. End-laps, eave, ridge assembly, gable flashings: Field-applied non-skinning sealant as specified in Section 07 92 00.

N. Standing Seam Roof Closures:

1. Outside closures: 24 gauge steel sheet.
2. Inside closures: 18 gauge Galvalume or G-40 galvanized coated steel complying with ASTM A 653/A 653M.

O. Through-Fastened Roof Closures: Provide closed-cell polyethylene inside [and outside] foam closures.

1. Bulk Density: 2 pounds per cubic foot.
2. Service Temperature: -100 to 180 degrees Fahrenheit.
3. Shore Hardness: 7 on AA scale or 51 on 00 scale when tested to ASTM D 2240.

2.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.

B. Structural Performance: Metal building systems and components to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings in accordance with the applicable code.
2. Deflection and Drift Limits:

    a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
    b. No greater than the following:

        1) Purlins and Rafters: Vertical deflection of 1/180 of the span.
        2) Girts: Horizontal deflection of 1/180 of the span.
        3) Metal Roof Panels: Vertical deflection of 1/240 of the span.
        4) Metal Wall Panels: Horizontal deflection of 1/240 of the span.
        5) Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
        6) Lateral Drift: Maximum of 1/500 of the building height at a 10-year MRI wind event.

C. Seismic Performance: Metal building system to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Wind Performance: Metal building system shall withstand the effects of wind forces determined according to ASCE/SEI 7-16. Framing members and fasteners shall support the components and

cladding loads to resist design wind forces within the deflection limits indicated. There shall be no provision requiring doors to be closed during wind events in order to meet performance requirements.

E. Snow Load Performance: Metal building system shall withstand the full roof snow load value. No reduction in roof snow load value due to slope or roof surface type.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: +110 deg F to -70 deg F, ambient.

G. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.

2. Snow Loads: As indicated on Drawings.

2.04 STRUCTURAL-STEEL FRAMING

A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."

B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters and rake beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Owner’s Representative.

2. Frame Configuration: Single gable.
3. Exterior Column: Tapered.
4. Rafter: Tapered.

E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

G. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

H. Bracing: Provide adjustable lateral bracing as follows:

1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50; or ASTM A529/A529M, Grade 50; minimum 5/8-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.

2. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.

2.05 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fascia, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fascia, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

D. Base member flashing: As indicated on Drawings

1. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other

defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

3. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

4. Design Pressure: As indicated on Drawings.

5. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

6. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal
   a. Fasteners for Pre-Finished Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

7. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

8. Elastomeric Sealant: ASTM C 920, elastomeric [**polyurethane**] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.06 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2. Fabricate metal joints configured to accept applied sealant providing weathertight seal and preventing metal to metal contact and minimizing noise resulting from thermal movement.

3. Sheet Metal Flashing and Trim: Fabricate or install flashing and trim to comply with manufacturer’s written instructions and construction drawings.

4. End Laps:
   a. Fabricate with 16 gauge backup plates and eight end lap joint fasteners installed in six pre-punched holes in flat and in dimples in trapezoidal legs.
   b. Apply mastic between panels and secure with self-drilling fasteners through panels and backup plate.
   c. Through roof fasteners may be used only at end laps and eaves.

5. Thermal performance as indicated.

F. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Clean and prepare in accordance with SSPC-SP2.

2. Coat with manufacturer’s standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

   a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.07 SOURCE QUALITY CONTROL

A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.

1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

    a. Joint Type: Snug tightened or pretensioned as required by manufacturer.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, ventilators, and other penetrations of roof and walls.

H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Joist Installation:

    a. Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
    b. Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
    c. Weld joist seats to supporting steel framework.

5. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.02 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform tests and inspections required by building codes or local Authorities Having Jurisdiction, and to submit reports. The Owner will engage a special inspector to perform field quality control and special inspections.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Tests and Inspections:
1. High-Strength, Field-Bolted Connections: Connections shall be inspected during installation according to RCSC’s “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.” Special inspection during installation of high strength bolts may follow provisions in the most current version of the IBC adopted by the state, when joints

require only snug-tight condition or when tension-indicator washers or twist-off bolts are used.

2. Welded Connections: Visual inspection of ¼ fillet single pass welds. In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1 and one of the following inspection procedures, at inspector's option:

   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

3. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

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SECTION 220100 - GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SECTION INCLUDES

A. Basic Plumbing Requirements specifically applicable to Division 22 as delineated in these specifications, in addition to Division 01 – General Requirements.

B. All provisions of Section 23 00 00, General HVAC Requirements, apply to Division 23.

1.03 SCOPE

A. Furnish all labor, materials, equipment, supervision of labor and performance of all operations required to completely install satisfactorily operating plumbing systems as defined herein and on Drawings.

B. Other Divisions of these Specifications apply to work generally defined by Division 22 & Division 23 Specifications and/or shown on Mechanical Drawings. For additional details, refer to Drawings detailing work under other Divisions. All work shown on the "M" series Drawings, 220000 & 230000 series Specifications is to be provided unless otherwise stated.

C. The drawings and specifications are complementary to each other. What is shown on one is as binding as if called for in both. The drawings are generally diagrammatic and are intended to show mechanical details in a schematic fashion. Do not scale mechanical drawings. Exact locations are not shown unless so indicated or specifically dimensioned. Typical connection diagrams are schematic and do not show the actual physical arrangement of equipment.

D. The plans do not necessarily show complete details of all the features that may affect the mechanical installations; however, it is the intent of the contract documents to provide a complete and satisfactory working installation.

E. Submit in writing to the Owner’s Representative for review details of any necessary or proposed departures from these Contract Documents and reasons therefore, as soon as practicable within 30 days after the award of the contract. Make no such departure without prior written approval of the Owner’s Representative.

F. Coordination of the Work: Coordinate work under this Division with work of other trades to avoid conflicts, errors, and delays.

G. Verify the approximate location of equipment and other mechanical system components shown on the Drawings and report any conflicts with openings, structural members, and components of other systems and equipment having fixed locations.

H. During the course of accomplishing the work defined herein and on the Contract Drawings, the Contractor discovers major damage, defect or deterioration to existing equipment or systems indicated as existing to remain, and where such damage, defect or deterioration will or might affect the safe and proper operation of such equipment and systems, the Contractor shall immediately notify the Owner's Representative in writing.

I. Coordinate mechanical work, submittals, and construction meetings with Commissioning requirements noted in other sections.

PART 2 - PRODUCTS

2.01 GENERAL

A. All Product provisions noted within Section 23 00 00, General Mechanical HVAC, apply to Division 22 work.

PART 3 - EXECUTION

3.01 GENERAL

A. All Execution provisions noted within Section 23 00 00, General HVAC Requirements, apply to Division 22 work.

END OF SECTION

SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

1. Motors.
2. Sleeves without waterstop.
3. Sleeves with waterstop.
4. Sleeve-seal systems.
5. Grout.
6. Silicone sealants.
7. Escutcheons.
8. Thermometers, bimetallic actuated, lead free.
9. Thermometers, filled system, lead free.
10. Thermometers, liquid in glass, lead free.
11. Thermometers, light activated, lead free.
12. Thermowells, lead free.
13. Pressure gauges, dial type, lead free.
14. Gauge attachments, lead free.
15. Test plugs, lead free.
16. Test-plug kits, lead free.
17. Sight flow indicators, lead free.

1.03 ACTION SUBMITTALS

A. Product Data:

1. For each type of product, excluding motors which are included in Part 1 of the plumbing equipment Sections.

   a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
   b. Include operating characteristics and furnished accessories.

B. Delegated Design Submittals: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

2. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
3. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
4. Alignment Guide Details: Detail field assembly and attachment to building structure.
5. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of gauge to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

1.07 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Domestic water for plumbing piping intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.

C. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.02 MOTORS

A. Motor Requirements, General:

1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
3. Comply with NEMA MG 1 unless otherwise indicated.
4. Comply with IEEE 841 for severe-duty motors.

B. Motor Characteristics:

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. above sea level.
2. 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.

C. Polyphase Motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Premium Efficient, as defined in NEMA MG 1.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.

    a. For motors with 2:1 speed ratio, consequent pole, single winding.
    b. For motors with other than 2:1 speed ratio, separate winding for each speed.

5. Multispeed Motors, Two Winding: Separate winding for each speed.
6. Rotor: Random-wound, squirrel cage.
7. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
8. Temperature Rise: Match insulation rating.

    a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    b. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

9. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Additional Requirements for Polyphase Motors:

10. 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.
11. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

    a. 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.
    b. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
    c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
    d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

12. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:

1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:

    a. Permanent-split capacitor.
    b. Split phase.
    c. Capacitor start, inductor run.
    d. Capacitor start, capacitor run.

2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. 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 will automatically reset when motor temperature returns to normal range.

2.03 SLEEVES AND SLEEVE SEALS

A. Sleeves with Waterstop:
1. Description: Manufactured PVC/HDPE or steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Stack-Sleeve Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Zurn Industries, LLC.

1. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

    c. Underdeck Clamp: Clamping ring with setscrews.

C. Sleeve-Seal Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Metraflex Company (The).

2. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

    b. Hydrostatic Seal: 20 psig minimum.
    c. Sealing Elements: EPDM-rubber or Nitrile (Buna-N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
    d. Pressure Plates: Carbon steel.
    e. Connecting Bolts and Nuts: Carbon steel, with zinc coating, ASTM B633 of length required to secure pressure plates to sealing elements.

D. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

E. Silicone Sealants:

1. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

    a. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

2. Silicone Sealant, S, P, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.
    b. Standard: ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

3. Silicone Foam Sealant: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

2.04 ESCUTCHEONS

A. Escutcheon Types:

1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

2. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

B. Floor Plates:

1. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.01 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant, seal the space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

3.02 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeves. Select to maintain fire resistance of floor/slab/wall.

3.03 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.04 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. 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.

3.05 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.06 INSTALLATION OF METERS AND GAUGES

A. Install thermometer with thermowell at each required thermometer location.

B. Install thermowells in vertical position in piping tees.

C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks.

H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

I. Install remote-mounted pressure gauges on panel.

J. Install valve and snubber in piping for each pressure gauge for fluids.

K. Install test plugs in piping tees.

L. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

3.07 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow space for service and maintenance of meters, gauges, machines, and equipment.

3.08 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gauges to proper angle for best visibility.

3.09 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:

1. Perform the following tests and inspections:

a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.10 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs-on-Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3.11 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Chrome-Plated Piping: One piece, steel or cast brass with polished, chrome-plated finish.
3. Insulated Piping:

a. One piece, steel with polished, chrome-plated finish.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:

b. One piece, steel with polished, chrome-plated finish.

5. Bare Piping at Ceiling Penetrations in Finished Spaces:

c. One piece, steel with polished, chrome-plated finish.

6. Bare Piping in Unfinished Service Spaces:

d. One piece, steel with polished, chrome-plated finish.

B. Install floor plates for piping penetrations of equipment-room floors.

C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: One piece, floor plate.

3.12 THERMOMETER, LEAD FREE, APPLICATION

A. Thermometers at inlet and outlet of each domestic water heater are to be the following:
   1. Direct-mounted, metal-case, vapor-actuated type.

B. Thermometer stems are to be of length to match thermowell insertion length.

3.13 THERMOMETER, LEAD FREE, SCALE-RANGE APPLICATION

A. Scale Range for Domestic Cold-Water Piping:

   1. 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping:

   1. 0 to 250 deg F.

3.14 PRESSURE-GAUGE APPLICATION

A. Pressure gauges at inlet and outlet of each water pressure-reducing valve are to be the following:

   1. Sealed, direct mounted, metal case.

END OF SECTION

SECTION 220523 - PLUMBING PIPING VALVES AND SPECIALTIES

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Backflow preventers.
   2. Wall hydrants.
   3. Ball Valves
   4. Drain Valves
   5. Trap-seal primer device.

1.03 REFERENCES

A. ASTM International:

   1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   2. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.04 SUBMITTALS

A. Section 013300 “Submittal Procedures”: Requirements for submittals.

B. Product Data: Submit manufacturer’s catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 CLOSEOUT SUBMITTALS

A. Section 017700 “Closeout Procedures”: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves and specialties.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 014000 “Quality Requirements”: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Section 014000 “Quality Requirements”: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.09 WARRANTY

A. Section 017700 “Closeout Procedures”: Requirements for warranties.

B. Furnish five year manufacturer warranty for specialties and valves excluding packing.

1.10 EXTRA MATERIALS

A. Section 017000 “Closeout Procedures”: Requirements for extra materials.

B. Furnish two packing kits for each size valve.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING VALVES AND SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 BACKFLOW PREVENTERS

A. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. WATTS; A Watts Water Technologies Company.

2. Standard: ASSE 1015, AWWA C510.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 7 psig maximum, through middle third of flow range.
5. Size: 1-inch.
6. Design Flow Rate: 6 gpm.
7. Selected Unit Flow Range Limits: 10 gpm
8. Pressure Loss at Design Flow Rate: 4 psig for sizes NPS 2 and smaller.
9. In "Body" Subparagraph below, not all manufacturers offer certified lead-free for "Bronze" option. If certified lead-free bronze is required, consult manufacturers.
10. Body: Bronze for NPS 2 and smaller.
11. End Connections: Threaded for NPS 2 and smaller.
12. Configuration: Designed for horizontal, straight-through flow.
13. Accessories:

    a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.

2.04 WALL HYDRANTS / HOSE BIBBS

A. Reference section 224000 “Plumbing Fixtures”.

2.05 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control
   2. Conbraco Industries
   3. Nibco, Inc
   4. Milwaukee Valve Company

B. Construction, 3 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends. Solder ends acceptable only on smaller than 1-inch size. Lead Free.

2.06 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 minimum CWP.
3. Size: NPS 3/4.
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.
4. Body: ASTM B62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.07 TRAP-SEAL PRIMER DEVICE (TP-1)

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Precision Plumbing Products.

2. Standard: ASSE 1018.
3. Pressure Rating: 80 psig maximum.
4. Body: Brass.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 017300 “Execution”: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.02 INSTALLATION

A. Backflow Preventers: Install 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. Do not install bypass piping around backflow preventers.

B. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

C. Install valves with stems upright or horizontal, not inverted.

D. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

E. Install 3/4-inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

F. Install valves with clearance for installation of insulation and allowing access.

G. Provide access where valves and fittings are not accessible.

H. Locate isolation valves near equipment so that they can be easily seen and operated from access points.

I. For installation of valves in fuel oil systems refer to Section 231113 “Facility Fuel-Oil Piping.”

3.03 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.04 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260523 "Control Voltage Electrical Power Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.05 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.06 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Backflow preventers.
   2. Wall hydrants.
   3. Trap-seal primer device.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.07 VALVE APPLICATIONS

A. Provide ball valves for pipe sizes 2 inches and smaller. Provide ball or gate valves for pipe sizes larger than 2 inches.

B. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install ball valves for throttling, bypass, or manual flow control services.

E. Install ball valves in domestic water systems for shut-off service.

F. Install ball valves in domestic water systems for throttling service.

END OF SECTION

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SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING AND EQUIPMENT

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Inserts.
   4. Flashing.
   5. Sleeves.
   6. Mechanical sleeve seals.
   7. Formed steel channel.
   8. Equipment bases and supports.

1.03 REFERENCES

A. American Society of Mechanical Engineers:

   1. ASME B31.1 - Power Piping.
   2. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   2. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

   1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Section 014000 “Quality Requirements”: Environmental conditions affecting products on site.

1.05 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Grinnell.

A. Plumbing Piping - Water:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2- to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
7. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

11. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.02 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.03 INSERTS

A. Manufacturers: Hilti.

B. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.05 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Acrylic.

2.06 MECHANICAL SLEEVE SEALS

A. Manufacturers: Thunderline Link-Seal, Inc. Model “L” or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and

pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

C. Designed for use with steel or plastic pipe.

D. Sleeve: Molded non-metallic HDPE sleeve with integral hollow, molded water-stop ring minimum four inches larger than the outside diameter of the sleeve itself. Provide pipe caps for use during concrete pouring. Thunderline Link-Seal Model CS or approved equal.

2.07 FORMED STEEL CHANNEL

A. Manufacturers: B-Line Systems.

B. Product Description: Galvanized 12 gage thick steel, with holes 1-1/2 inches on center.

2.08 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

B. Color: Dark gray.

2.09 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products [or products tested by independent testing laboratory].
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 017300 “Execution”: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Obtain permission from Architect/Engineer before using powder-actuated anchors.

D. Do not drill or cut structural members.

3.03 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2-inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping or sheet lead packing between hanger or support and piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance for hangers from structure and other equipment for installation of insulation. Refer to Section 220700.

3.04 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Structural Sheet Note for Concrete Specification.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.06 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

3.07 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:

    a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
    c. Pack void with backing material.
    d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where cable tray, bus, cable bus, conduit, wireway, trough, and penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

E. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:

    a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
    c. Install type of firestopping material recommended by manufacturer.

2. Install escutcheons, floor plates, or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
4. Interior Partitions: Seal pipe. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.08 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.09 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.10 PROTECTION OF FINISHED WORK

A. Section 017300 “Execution”: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.11 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10-foot length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	3/8
Copper Tube, 1-1/2 inches to 2 inches	8	3/8
Copper Tube, 2-1/2 inches and larger	8	1/2
PEX Tube	3	3/8
Steel, 2 inches and smaller	10	3/8
Steel, 2-1/2 inches to and 3 inches	11	1/2

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Steel, 4 inches and larger	14	5/8

3.12 START-UP/DEMONSTRATION

A. As specified in Section 017700 “Closeout Procedures.

B. The CONTRACTOR shall demonstrate to the satisfaction of the DEPARTMENT, the complete and proper support of all piping systems. The demonstration shall include, but not be limited to the following:

1. Proper installation and support of all piping systems, including the installation of sleeves, seismic bracing, anchors and expansion joints.

END OF SECTION

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SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Restraints - rigid type.
   2. Restraints - cable type.
   3. Restraint accessories.

1.03 DEFINITIONS

A. IBC: International Building Code.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component.
   2. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by ICC-ES product listing.
   3. Annotate to indicate application of each product submitted and compliance with requirements.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports:

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: ICC-ES product listing.

PART 2 - PRODUCTS

2.01 RESTRAINTS - RIGID TYPE

A. Description: Shop or field-fabricated bracing assembly made of ANSI/AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.02 RESTRAINTS - CABLE TYPE

A. Seismic-Restraint Cables: ASTM A1023/A1023M galvanized or ASTM A603 galvanized-steel or ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.

B. Restraint cable assembly and cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge type end fittings do not comply and are unacceptable.

2.03 RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod. Non-metallic stiffeners are unacceptable.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

D. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive seismic control devices 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.

3.02 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and seismic load within specified loading limits.

3.03 INSTALLATION OF SEISMIC-RESTRAINT DEVICES

A. Provide seismic-restraint devices for systems and equipment where required by applicable codes.

B. Installation of seismic restraints must not cause any stresses, misalignment, or change of position of equipment or piping.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

D. Install seismic-restraint cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in Section 22 11 16 "Domestic Water Piping" and Section 22 11 19 "Domestic Water Piping Specialties" for piping flexible connections.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform tests and inspections with the assistance of a factory-authorized service representative.
2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
4. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
5. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
6. Test to 90 percent of rated proof load of device.

C. Remove and replace malfunctioning units and retest as specified above.

D. Units will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 220553 – IDENTIFICATION FOR PLUMBING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

1.02 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. National Fire Protection Association:

1. NFPA 99 - Standard for Health Care Facilities.

1.03 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 017700 - Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.05 QUALITY ASSURANCE

A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

C. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Manufacturers: Seton Identification Products or approved substitute.

B. Product Description: Laminated three-layer plastic with engraved black or white letters on contrasting background color. Minimum 1/2 Inch text.

C. Plate minimum size 3/4" x 2-1/2"

2.02 TAGS

A. Plastic Tags:

1. Manufacturers: Seton Identification Products or equal.
2. Bemis Lamicoid, Laminated three-layer plastic with engraved letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:

1. Manufacturers: Seton Identification Products or equal.
2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers: Seton Identification Products or equal.
2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.03 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2-inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
4. Ductwork and Equipment: 1-3/4 inches high letters.

B. Stencil Paint: As specified in Section 099123 “Interior Painting”, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.04 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers: Seton Identification Products or equal.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers: Seton Identification Products or equal.
2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.05 LABELS

A. Manufacturers: Seton Identification Products or equal.

B. Description: Aluminum, size 1.9 by 0.75 inches, adhesive backed with printed identification.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 099123 “Interior Painting” for stencil painting.

3.02 INSTALLATION

A. Apply stencil painting in accordance with Section 099123 “Interior Painting”.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. For pipe markers, provide complete wraps of adhesive direction arrow tape around both ends of marker.

F. Install tags using corrosion resistant chain. Number tags consecutively by location.

G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with tags showing service and valve number.

J. Valve tags to indicate whether valve is normally open or normally closed (NO or NC). Number tags consecutively by location.

K. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4-inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

L. Provide ceiling tacks to locate valves, dampers equipment, and other maintained devices above T-bar type panel ceilings.

1. Locate tack on panel closest to the device.
2. For equipment requiring maintenance, such as VAV boxes, locate ceiling tack at access location.
3. Write on the tack with permanent marker an identifier such as the valve or equipment tag.

3.03 SCHEDULES

IDENTIFICATION

Common abbreviations are shown; submit proposed abbreviations for other systems as needed.

CW Domestic Cold Water
HW Domestic Hot Water

FOS Fuel Oil Supply
FOR Fuel Oil Return

END OF SECTION

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SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Plumbing piping insulation, jackets and accessories.
   2. Plumbing equipment insulation, jackets and accessories.
   3. Process plumbing exterior insulation, jackets, and accessories.

1.03 REFERENCES

A. ASTM International:

   1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
   4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
   5. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
   6. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
   7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
   8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
19. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
20. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.08 WARRANTY

A. Section 017700 – Closeout Procedures: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for manmade fiber.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:

1. CertainTeed.
2. Knauf.
3. Johns Manville.
4. Owens-Corning.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:

1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.

C. Manufacturers for Polyisocyanurate Foam Insulation Products:

1. Dow Chemical Company.
2. Johns Manville.

D. Manufacturers for Extruded Polystyrene Insulation Products:

1. Dow Chemical Company or approve equal.

E. Manufacturers for Aluminum Jacketing Products:
   1. Johns Manville or approved equal.

2.02 INTERIOR PLUMBING PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.

   1. Thermal Conductivity: 0.23 at 75 deg F
   2. Operating Temperature Range: 0 to 850 deg F
   3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
   4. Jacket Temperature Limit: minus 20 to 150 deg F

B. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.

   1. Thermal Conductivity: 0.27 at 75 deg F
   2. Operating Temperature Range: Range: Minus 70 to 180 deg F

2.03 INTERIOR PLUMBING PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:

   1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

B. Aluminum Pipe Jacket:

   1. ASTM B209.
   2. Thickness: 0.016 inch thick sheet.
   3. Finish: Embossed.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.04 INTERIOR PLUMBING PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self adhesive closure. Thickness to match pipe insulation.

F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

I. Adhesives: Compatible with insulation.

2.05 EXTERIOR PROCESS PIPE INSULATION

A. Insulation shall be polyisocyanurate insulation:

a.	Density:	greater than 2.7 lbs/ft^3
b.	“K” Factor:	0.19 Btu-in/hr-ft2 -°F @ 75°F
c.	Compressive Strength:	greater than 30 psi @ 75°F
d.	Closed Cell Content:	greater than or equal to 85%
e.	Thickness:	2 inches

B. Exterior pipe insulation shall include a heat trace channel.

2.06 EXTERIOR PROCESS PIPE INSULATION JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Thickness: minimum 0.024 inch thick.
b. Finish: Jacketing shall have a smooth, stucco embossed, or corrugated finish
c. Moisture Barrier for Outdoor Applications: 3-mil- thick polysurlyn.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Flange and union covers.
4) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

C. Banding for jacketing shall be 0.02” thick by 1/2” wide stainless steel or as specified by manufacturer.

D. Sealant shall be per manufacturer's specifications.

E. Vapor Retarder Film or Tape: Compatible with insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 013000 – Project Management and Coordination: Coordination and project conditions.

B. Verify piping has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

D. Prepare surfaces and install insulation, jacketing, and accessories in accordance with manufacturer's recommendations, building codes, and industry standards.

3.02 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 078413 – Penetration Firestopping for penetrations of assemblies with fire resistance rating greater than one hour.

C. Hot Piping Systems Greater Than 140 deg F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
3. Insulate flanges and unions at equipment.
4. Insulation shall be continuous at all hangers, supports, penetrations or clamps.
5. Exception: Branch piping serving finned tube from below shall not require full insulation through the floor pipe penetration. Contractor to install mineral wool or ½" insulation in interstitial space. The openings shall be sleeved.

D. Inserts and Shields:

1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.

    a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.

b. Insert Material: Approved compression resistant insulating material suitable for planned temperature range and service.

1) Hydrous calcium silicate pipe insulation, rigid molded white; asbestos free.
2) Polyurethane Core System: 5 pcf density, 72 psi compressive strength. K-Flex 360 or approved equal.
3) Wood blocks are not acceptable.

c. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts. Shields shall extend a minimum of 6 inches beyond hanger in both directions.

3. Piping Supported by Roller Type Pipe Hangers: Install steel shield between roller and inserts.

E. Insulation Terminating Points:

1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.

F. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer’s recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

G. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

H. 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 that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 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. Finish exposed surfaces with a metal jacket.

I. Install metal jackets to be waterproof and weather-tight. Install, secure, and seal jacketing per manufacturer’s specifications.

3.03 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.INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Over 140 deg F:

1. Insulate flanges and unions with removable sections and jackets.
2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

E. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

H. Prepare equipment insulation for finish painting. Refer to Section 099123 – “Interior Painting.”

3.04 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Domestic Cold Water	P-1 or P-5	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0
Fuel Oil Supply and Return	P-1 or P-5	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0

END OF SECTION

SECTION 221116 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Copper tube and fittings.
   2. PEX tube and fittings.
   3. PP-R pipe and fittings.
   4. Piping joining materials.
   5. Transition fittings.
   6. Dielectric fittings.

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Pipe and tube.
   2. Fittings.
   3. Joining materials.
   4. Transition fittings.

1.04 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.05 WARRANTY

A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.
   1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

B. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Buried Water Piping within 5-feet of the building specified in Civil Sheet Notes for HDPE water pipe.

2.02 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, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:
1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

F. Copper Pressure-Seal-Joint Fittings:
1. Fittings for 2 inch and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

G. Copper-Tube, Extruded-Tee Connections:
1. Description: Tee formed in copper tube according to ASTM F 2014.

2.03 PEX TUBE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. IPEX USA LLC.
2. REHAU.

3. Uponor.

B. Tube Material: PEX plastic according to ASTM F876 and ASTM F877.

C. Fittings: ASTM F1807, metal insert and copper crimp rings ASTM F1960, cold expansion fittings and reinforcing rings.

D. HDPE / PEX Transition Fitting for Raw Water Entrance:
1. Provide: HDPE socket weld / threaded brass fitting to which a brass threaded PEX connector can be added. Brass shall be lead free for potable water, listed AWWA C-901 and NSF.
2. Manufacturer: Integrity Fusion Products or equal.

2.04 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B32, lead-free alloys.

B. Flux: ASTM B813, water flushable.

C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.05 TRANSITION FITTINGS

A. General Requirements:
1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.06 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:
1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. 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. Drawn-temper copper tube, ASTM B88, Type L; cast or wrought-copper, solder-joint fittings; and brazed or soldered joints.
   2. Drawn-temper copper tube, ASTM B88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.
   3. Drawn-temper copper tube, ASTM B88, Type L; copper push-on-joint fittings; and push-on joints.
   4. PEX tube, NPS 1 and smaller.
      a. Fittings for PEX tube:
         1) ASTM F1807, metal insert and copper crimp rings.
         2) ASTM F1960, cold expansion fittings and reinforcing rings.

3.02 EARTHWORK

A. Refer to civil specifications for excavating, trenching, and backfilling.

3.03 INSTALLATION OF PIPING

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.", to be limited to trap primer piping sloping to drain to floor drain traps.

C. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "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 to permit valve servicing.

J. 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.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install PEX tubing with loop at each change of direction of more than 90 degrees.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install pressure gauges on suction and discharge piping for each plumbing pump and pressure reducing valve.

P. Install thermometers on inlet and outlet piping from each water heater.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.04 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. 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. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.05 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.06 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 inch and Smaller: Use dielectric nipples or unions.

3.07 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 230548 “Mechanical Sound, Vibration, and Seismic Control."

B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for copper tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install vinyl-coated hangers for PP piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support horizontal piping within 12 inches of each fitting.

G. Support vertical runs of copper tubing and piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

H. Support vertical runs of PP-R piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

I. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.08 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

3.09 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
      a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
      b. Adjust calibrated balancing valves to flows indicated.
   5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Piping Inspections:
      a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
      b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
         1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
         2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
      c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
      d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
   2. Piping Tests:
      a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
      b. Test for leaks and defects in new piping and fittings. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
      c. Leave 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 100 psig(use maximum 80 psi in systems using PEX piping). Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
      e. Hydrostatic testing and documentation of test results for polypropylene piping to be in accordance with the manufacturer's instructions and submitted to the manufacturer upon successful completion per warranty requirements.
      f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
      g. 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.

3.12 CLEANING

A. Clean and sanitize domestic water piping as follows:
   1. Purge and sanitize new piping before using.
   2. Use purging and disinfecting procedures prescribed 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 NSF 60 certified chlorine. Isolate and allow to stand for three hours.

c. After the standing time, flush system with clean, potable water until chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.

d. Repeat procedures if biological examination shows contamination.

e. Submit water samples in sterile bottles to approved testing agency. Follow the test sampling procedures outlined in AWWA C651 5.1.3.

B. Provide two (2) approved Bac-T tests taken 16 hours apart prior to placing the new or repaired service pipe into service.

C. Prepare and submit reports of purging and disinfecting activities to Engineer of record, and ADEC permitting agent. Include copies of water-sample approvals from testing agency.

END OF SECTION

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SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes Pipe, pipe fittings, valves, and connections for piping systems:
   1. Sanitary Waste.
   2. Vent Piping.

1.03 ACTION SUBMITTALS

A. Action submittals are submittals requiring responsive action and return of reviewed documents to Contractor.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information. Indicate valve data and ratings.

C. C. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

   1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

B. Do not install underground piping when bedding is wet or frozen.

1.06 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10 ft. head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment":

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Component Importance Factor: 1.0.

2.02 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in plan set for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 SANITARY SEWER, AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301, hub-less.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

B. ABS Pipe: ASTM D2661, Acrylonitrile-Butadiene-Styrene (ABS) material.

1. Fittings: ABS, ASTM D2661.
2. Joints: ASTM D2235, solvent weld.

2.3 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.
2. Joints (Under 3-inch size): CISPI 301, neoprene gaskets and stainless steel clamp-and-shield assemblies. Standard duty.
3. Joints (3-inch and larger): CISPI 301, neoprene gaskets and stainless steel clamp-and-shield assemblies. Heavy Duty Coupling Assembly; Clamp-All or Anoco Husky Series 4000 couplings. No substitutions.

B. Copper Tube: ASTM B306, type DWV. Acceptable only on 2-inch and under horizontal waste and vent piping located inside plumbing walls.

1. Fittings: ASME B123, cast bronze, or ASME B129, wrought copper.
2. Joints: ASTM B32, solder, Grade 50B

2.04 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.
    d. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C564, rubber.
        2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926 PVC.
        3) For Dissimilar Pipes: ASTM D5926 PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

    a. Description:

        1) Standard: ASSE 1079.
        2) Pressure Rating: 150 psig.
        3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

    a. Description:

        1) Standard: ASSE 1079.
        2) Factory-fabricated, bolted, companion-flange assembly.

C. Fixed Air Gap Fitting:
1. Manufacturer: Zurn Z1025 or equal.
2. Provide Fixed air gap, dura coated cast iron boyd with slip joint inlet and no-hub outlet.

PART 3 - EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

C. Install piping free of sags and bends.

D. Install fittings for changes in direction and branch connections.

E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. 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.
2. 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.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

F. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

G. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

H. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A 21.5.

I. Install aboveground copper tubing in accordance with CDA's "Copper Tube Handbook."

J. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

K. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

M. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

N. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 221116 "Domestic Water Piping Specialties."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220100 "General Plumbing Requirements."

3.03 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

E. Join stainless steel pipe and fittings with gaskets in accordance with ASME A112.3.1.

F. Join copper tube and fittings with soldered joints in accordance with ASTM B828. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.

3.04 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

3.05 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install 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 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

5. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52 spring hangers.

C. Install hangers for cast-iron and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

E. Support vertical runs of cast-iron and copper soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.06 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 waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste 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 waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with 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.

3.07 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.08 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 waste and vent piping in accordance with 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.

    a. 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 waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. 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.

    a. 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.
    b. Air pressure must remain constant without introducing additional air throughout period of inspection.
    c. 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.

3.09 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping 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 Plastic Piping: Protect ABS plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller are to be the following:

1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless steel pipe and fittings, sealing rings, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 4 (DN 100) is to be the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless steel pipe and fittings gaskets, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M; copper pressure fittings; and soldered joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller are to be the following:

1. Service cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty cast-iron hubless-piping couplings; and coupled joints.
3. Stainless steel pipe and fittings, gaskets, and gasketed joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

SECTION 221319 – SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

   1. Section 074113.16 ”Standing-Seam Metal Roof Panels” for metal roof flashing assemblies and preformed flashing.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Show fabrication and installation details for frost-resistant vent terminals.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.02 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Threaded, adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Inside calk.
7. Closure: Brass plug with straight threads and gasket or brass plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top-Loading Classification: Medium Duty.
12. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Size: Same as floor drain inlet.

D. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

E. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

F. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 PIPING CONNECTIONS

A. Comply with requirements in Section 22 13 16 “Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.03 LABELING AND 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 identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 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

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Commercial, light-duty, storage, electric, domestic-water heaters.
   2. Domestic-water heater accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

B. Product Certificates: For each electric, domestic-water heater.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.06 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1) Storage Tank: **Six** years.
2) Controls and Other Components: **Six** years.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.02 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS (WH-01)

A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by the following: A. O. Smith Corporation.
2. Standard: UL 174.
3. Storage-Tank Construction: Steel, vertical arrangement.

    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig
    c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed, Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal with hose-end connection.
    d. Insulation: Comply with ASHRAE/IES 90.1.
    e. Jacket: Steel with enameled finish or high-impact composite material.
    f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    g. Heating Elements: Electric, screw-in immersion type.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Control: High-temperature-limit cutoff device or system.
    j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction with legs for off-floor installation.

B. Capacity and Characteristics: See drawing schedule.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
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 floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

A. Install the following piping accessories.

1. On Cold Water Supply:

a. Thermometer well and thermometer.
b. Strainer.
c. Pressure gauge.
d. Shutoff valve.
e. Drain Valve

2. On Hot Water Discharge:

a. Thermometer well and thermometer.
b. Shutoff valve.
c. Temperature and pressure valve.
d. Drain valve.

B. Install discharge piping from relief valves down to within 6 inches of floor.

C. Install water heater trim and accessories furnished loose for field mounting.

D. Install electrical devices furnished loose for field mounting.

E. Install control wiring between water heater control panel and field mounted control devices.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 05 23 "Plumbing Piping Valves and Specialties.

G. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

H. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 22 05 23 "Plumbing Piping Valves and Specialties.

I. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill electric, domestic-water heaters with water.

K. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water to contain less than 0.25 percent of lead by weight.

3.02 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

END OF SECTION

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SECTION 224000 – PLUMBING FIXTURES

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS).
   2. Build America, Buy America Act.

1.02 SUMMARY

A. Section Includes:

   1. Hose bibbs.
   2. Emergency Eye Wash.

1.03 REFERENCES

A. American National Standards Institute:
   1. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

B. American Society of Mechanical Engineers:
   1. ASME A112.18.1 - Plumbing Fixture Fittings.

C. International Association of Plumbing and Mechanical Officials (IAPMO)

   1. UPC – Uniform Plumbing Code

D. International Code Council

   1. IBC – International Building Code
   2. ICC A117.1 – Accessible and Usable Buildings and Facilities
   3. IPC – International Plumbing Code

1.04 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 CLOSEOUT SUBMITTALS

A. Section 017700 “Closeout Procedures”: Requirements for submittals.

B. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.06 COORDINATION

A. Confirm location and size of all fixtures and openings with all trades. Coordinate locations for structural fixture supports in walls, floors, and structural members.

B. Coordinate electrical locations and requirements for fixtures with electrical trade.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.01 HOSE BIB (HB-1)

A. Manufacturers: Woodford model 24P or approved equal.

B. Exterior Hose Bib: ASSE 1011; Anti-contamination wall faucet for use in warm space. Single faucet with 3/4 inch supply, vacuum breaker, with hand wheel, and 3/4 inch hose thread spout. Bronze or brass with integral mounting flange, replaceable hexagonal disc.

2.02 HOSE BIB (HB-2)

A. Manufacturers: Woodford model 65 or approved equal.

B. Exterior Hose Bib: ASSE 1019-B; Cast bronze, non-freeze wall hydrant, with integral vacuum breaker, chrome plate face, loose key “T” handle, automatic draining, for exterior wall installation, and 3/4-inch hose threaded spout.

2.03 EMERGENCY EYEWASH (EW-1)

A. Manufacturers: Bradley Model S19-921 or approved equal.

B. Self-contained, gravity eyewash with 7-gallon translucent tank of impact resistant plastic. Provide with stainless steel mounting bracket for polypropylene pedestal and pull down arm. Full, one year warranty.

2.04 EMERGENCY EYEWASH (EW-2)

A. Manufacturers: Bradley Model S19-788LHS or approved equal.

B. ANSI Z358.1-2004; Portable, pressurized emergency eye wash, 15-gallon stainless steel pressurized tank, 30-3/8 inches high by 12-1/4 inches diameter, with tire type filler valve with 0 to 160 psi air gauge and overpressure relief valve. Eyewash to have twin chrome plated brass, soft-flow eyewash heads, hand-operated, automatic flow control valve with stay-open valve, with high-visibility stainless steel push handle, protective eyewash dust covers, with safety markings and emergency sign. Full, one-year warranty.

C. Provide one case of water preservative concentrate consisting of 8 oz. water preservative concentrate intended to mix with 6-20 gallons of potable water to prevent bacterial, fungal and algae growth for up to four months.

2.05 UTILITY SINK (P-1)

A. Reference section “224216 - Commercial Sinks”.

2.06 TRAP PRIMER (TP-1)

A. Reference section 220523 – “Plumbing Piping Valves and Specialties”.

PART 3 - EXECUTION

3.01 GENERAL

A. Install fixtures in accordance with manufacturer’s recommended installation instructions.

B. Provide maintenance access to all fixtures and those appurtenances that require maintenance, replacement, or isolation.

C. Install Work in accordance with the Uniform Plumbing Code, State of Alaska, Borough of Yakutat standards.

D. Install emergency eyewash and shower equipment in accordance with ANSI Z358.1.

3.02 EXAMINATION

A. Section 013100 “Project Management and Coordination”: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

3.03 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.04 INSTALLATION

A. Install components level and plumb.

B. Install and secure fixtures in place with wall supports and bolts.

3.05 INTERFACE WITH OTHER PRODUCTS, SYSTEMS, AND TRADES

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

B. Provide structural backing/support in walls, floor, and structural components per manufacturer's recommendations, contract documents, code compliance, and local Authority Having Jurisdiction's requirements.

C. Verify that adjacent finishes are ready for installation of the fixture.

1. Wall and floor surfaces are to be finished and sealed prior to fixture installation.

3.06 ADJUSTING

A. Section 017700 "Closeout Procedures": Testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.07 CLEANING

A. Section 017700 "Closeout Procedures": Final cleaning.

B. At completion, clean plumbing fixtures and equipment.

3.08 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017300 "Execution": Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Utility sinks.
   2. Manually operated sink faucets.
   3. Supply fittings.
   4. Waste fittings.
   5. Sink supports.
   6. Grout.

B. Related Requirements:
   1. Section 224100 "Residential Plumbing Fixtures" for residential sinks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
   2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sinks and faucets to include in operation and maintenance manuals.

   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

      a. Servicing and adjustments for automatic faucets.

PART 2 - PRODUCTS

2.01 UTILITY SINKS

A. Utility Sinks - Stainless Steel, Freestanding (P-1):
1. Provide one piece sink basin with drainboard and backsplash. Welded leg assembly shall support entire unit.

2. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Advance Tabco.

3. Source Limitations: Obtain sinks from single source from single manufacturer.
4. Fixture:

a. Standards:

1) ASME A112.19.3/CSA B45.4.
2) NSF 2.

b. Type: Stainless steel, freestanding, sound-deadened unit with backsplash and drain board.
c. Number of Compartments: One.
d. Overall Dimensions: 43” x 20” .
e. Material: 18 gauge, Type 304 stainless steel.
f. Compartment:

1) Dimensions: 16” x 20”.
2) Drain: NPS 1-1/2 tailpiece stainless steel basket type with stopper.
3) Drain Location: Centered in compartment.

g. Integral Drainboard: Left side.

1) Dimensions: 18”.

5. Legs and Feet: Stainless steel tubing legs with adjustable bullet feet.
6. Faucet(s): Manually Operated Sink Faucets.

a. Number Required: One.
b. Mounting: On backsplash.

7. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Loose key.
2) Risers: NPS 1/2, chrome-plated, rigid-copper pipe.

8. Waste Fittings:

    a. Standard: ASME A112.18.2/CSA B125.2.
    b. Trap(s):

        1) Size: NPS 2.
        2) Material:

            a) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.
            b) Stainless steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless steel tube to wall; and stainless steel wall flange.

    c. Continuous Waste:

        1) Size: NPS 2.
        2) Material: Chrome-plated, 17-gauge brass tube.

2.02 MANUALLY OPERATED SINK FAUCETS

A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Commercial Sink Faucets - Manual Type: Two-handle mixing.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Advance Tabco.

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
5. Body Type: Widespread.
6. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 1.5 gpm.
9. Mounting Type: Back/wall, exposed.
10. Valve Handle(s): Quarter turn wedge style handles.
11. Spout Type: Swing.
12. Vacuum Breaker: Not required for hose outlet.
13. Spout Outlet: Aerator Plain end.

2.03 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper pipe.

2.04 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.
2. Material:

a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

2.05 GROUT

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls and floors for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install sinks level and plumb in accordance with rough-in drawings.

B. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

C. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

D. Seal joints between sinks and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

3.05 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 230100 – GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 21, 22, and 23 Sections as delineated in these specifications, in addition to Division 01 – General Requirements.

1.03 SCOPE

A. Furnish all labor, materials, equipment, supervision of labor and performance of all operations required to completely install satisfactorily operating mechanical and plumbing systems as defined herein and on Drawings.

B. Major items of work include, but are not limited to, the installation of the following systems:
   1. Plumbing systems.
   2. Heating, ventilation & air conditioning systems.
   3. Heat generation systems.
   4. Heat transfer systems.
   5. Air handling systems.
   6. Controls systems.

C. Other Divisions of these Specifications apply to work generally defined by Division 21, 22, and Division 23 Specifications and/or shown on Mechanical Drawings. For additional details, refer to Drawings detailing work under other Divisions. All work shown on the "M" series Drawings, Division 22 and 23 Specifications, and referenced Division 21 Specifications is to be provided unless otherwise stated.

D. The drawings and specifications are complementary to each other. What is shown on one is as binding as if called for in both. The mechanical drawings are generally diagrammatic and are intended to show mechanical details in a schematic fashion. Do not scale mechanical drawings. Exact locations are not shown unless so indicated or specifically dimensioned. Typical connection diagrams are schematic and do not show the actual physical arrangement of equipment. The plans do not necessarily show complete details of all the features that may affect the mechanical installations; however, it is the intent of the contract documents to provide a complete and satisfactorily working installation.

E. Submit in writing to the Owner’s Representative for review details of any necessary or proposed departures from these Contract Documents and reasons therefore, as soon as practicable within

30 days after the award of the contract. Make no such departure without prior written approval of the Owner's Representative.

F. Coordination of the Work: Coordinate work under this Division with work of other trades to avoid conflicts, errors, and delays.

G. Verify the approximate location of equipment and other mechanical system components shown on the Drawings and report any conflicts with openings, structural members, and components of other systems and equipment having fixed locations.

H. During the course of accomplishing the work defined herein and on the Contract Drawings, the Contractor discovers major damage, defect or deterioration to existing equipment or systems indicated as existing to remain, and where such damage, defect or deterioration will or might effect the safe and proper operation of such equipment and systems, the Contractor shall immediately notify the Owner's Representative in writing.

1.04 REFERENCES

A. Codes and Standards: All work and materials shall comply with the latest issues of the following:

1. American Gas Association (AGA).
2. Air Moving and Conditioning Association (AMCA).
3. American National Standards Institute (ANSI).
4. Air-Conditioning and Refrigeration Institute (ARI).
5. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).
6. American Society of Mechanical Engineers (ASME).
7. American Society for Testing Materials (ASTM).
8. American Water Works Association (AWWA).
9. American Welding Society (AWS).
10. Environmental Protection Agency (EPA).
11. Hydraulic Institute (HI).
12. International Building Code (IBC).
13. International Fire Code (IFC).
14. International Fuel Gas Code (IFGC)
15. International Mechanical Code (IMC).
16. National Bureau of Standards (NBS).
17. National Environmental Balancing Bureau (NEBB).
18. National Electrical Code (NEC).
19. National Electrical Manufacturers Association (NEMA).
20. National Fire Protection Association (NFPA).
21. Occupational Safety and Health Administration (OSHA).
22. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
23. Underwriters Laboratories, Inc. (UL).
24. Uniform Plumbing Code (UPC).
25. All base materials shall comply with standards of ASTM and ANSI.

1.05 QUALITY ASSURANCE

A. All work and materials shall be in accordance with applicable codes, standards and ordinances, rules and regulations of the Fire Marshal and of the utility companies. Nothing in the Drawings and Specifications shall be construed as requiring or permitting work in violation of such codes.

B. Rulings and interpretations of the agencies having jurisdiction shall be considered as part of the codes and regulations if commonly known to the trade prior to bidding.

C. Whenever the Drawings and Specifications require higher standards than the codes and regulations, the Drawings and Specifications shall govern.

D. Only craftsmen skilled in their trade shall be employed.

E. Fan Requirements:

1. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
3. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
4. Balance Quality: Conform to AMCA 204.

1.06 QUALIFICATIONS

A. Manufacturers: Company specializing in manufacturing products specified in subsequent sections shall have a minimum three years of experience.

B. Installers: Company specializing in performing Work of this section with a minimum three years of experience.

1.07 SUBMITTALS

A. Submit shop drawings, product data, material data sheets, manufacturers' literature, and all other items as specified in Division 01 and the individual sections of Divisions 21, 22, and 23. Incomplete or partial Division 21, 22, and 23 submittals will be returned without review.

B. Shop Drawings and Manufacturer's Literature:

1. Submit large scale dimensioned shop drawings certified by manufacturer of major equipment and other equipment as may be directed by the Owner's Representative.
2. Coordination Drawings: Submit shop drawings for work in congested areas, indicating solutions to space problems and coordination with work by other trades and specification divisions. As the coordination drawings provide the means to resolve space conflicts and issues, likewise they will serve as the vehicle to sequence work. Space and scheduling will have been resolved prior to the start of work. Do not proceed without obtaining prior approval of shop drawings from the Department. These drawings must indicate work by other trades including, but not limited to:

a. Mechanical equipment.

b. Ductwork.
c. Plumbing piping and equipment.
d. Heating and piping.
e. Electrical work including, but not limited to:

1) Panels, transfer switches.
2) Disconnects, motor starters, VFDs.
3) Conduits 3 inches and larger.
4) Banks of conduits larger than a total width of 12 inches.
5) Junction or pull boxes greater than 12 inches by 12 inches.
6) Cable trays.
7) Busways.
8) Indicate on the drawings the associated NEC clearances for the above items.

f. Structural members.
g. Architectural features including door swings.

3. Shop drawings for the various systems shall be at a minimum scale of 1/2 inch =1 foot, shall be completely dimensioned, and shall clearly show the following:

a. Legend and abbreviation table.
b. Fittings.
c. Offsets and transitions.
d. Sizes.
e. Mounting heights and basis of given height (e.g., bottom of duct).
f. Duct turning vanes and air extractors.
g. Fire and smoke dampers.
h. Volume dampers (different symbols to be used for manual verses remote linkage dampers).
i. Duct lining.
j. Valve types and locations.
k. Drains and vents.
l. Insulation.
m. Sound traps.
n. Access doors.
o. Building access panels.
p. Flexible connections.
q. Duct and pipe sizes.
r. Duct gage, construction, reinforcement, and material.
s. Duct hangers and supports.
t. Duct sealing methods and requirements.
u. Fire and smoke damper installation details.
v. Exterior wall and roof penetration details.
w. Sleeve details.

C. Submit shop drawings of any product that is not the standard catalog product of an established manufacturer and is fabricated by the Contractor.

D. Submit shop drawings and other items as specified in the individual Sections.

E. Include with shop drawings of fabricated items the basis of design and design calculations.

1.08 CLOSEOUT SUBMITTALS

A. Submit all required certifications and testing reports as specified in Division 01 and as follows:

1. Upon completion of instruction, submit a certification that instruction in the maintenance and operation of all mechanical systems and equipment, as specified herein, has been provided to designated personnel.
2. The certification shall:

    a. List systems and equipment which were the subject of instruction,
    b. List the names personnel instructed the dates of instruction,
    c. List the names of the personnel providing instruction,
    d. List the appropriate areas of instruction,
    e. List the dates of classroom and on-site instructional session, and
    f. Be signed by all individuals participating in the instruction (both instructor and instructed).

B. Operating and Maintenance Data:

1. Provide six (6) sets of each type of instruction bound together in D-ring metal-ringed hardcover binders with removable pages, with a typewritten index indicating location of items in the work. Any information not pertinent to this work shall be deleted or neatly and completely lined out. Binders shall be of capacity to allow a minimum of 20 percent expansion.
2. The following components of the mechanical portion of the maintenance manual shall be printed so as not to fade, be permanently framed, glass or plexiglass covered and mounted in a convenient location in the respective mechanical room where the equipment and/or systems are located:

    a. Pipe and duct identification schedules.
    b. Valve directory.
    c. Equipment nameplate directory.
    d. System schematic drawings.
    e. Master maintenance schedule.

3. Operating and maintenance data must be provided for Owner’s Representative approval at least thirty (30) days prior to Substantial Completion. If approved operation and maintenance instructions are not on hand at the time of Substantial Completion and/or occupancy, the Contractor, at his own expense, shall make all repairs, replacements and installation of any components that may be destroyed or damaged due to the absence of specified instructions, and shall hold the Owner harmless.

C. Submit mechanical HVAC system start-up, testing, commissioning, and demonstration plans.

D. Submit controls system start-up and demonstration plans.

E. Submit a mechanical system operating instruction training schedule complete with class outline lesson plan that includes training topics and durations.

F. Project Record Documents: Record actual locations of components and tag numbering. Record actual locations and deviations of piping from drawings. Indicate drain and test locations.

G. Operation and Maintenance Data: Submit spare parts lists.

1.09 PROJECT CONDITIONS

A. Site Visit: It is advised that the Contractor visit the site and verify the exact conditions relating to his work and obtain such information as may be necessary to provide an intelligent and conclusive bid. No allowance will be made on behalf of the Contractor for any extra expense due to failure on his part to make such a visit.

B. Protection: Protect surrounding areas and surfaces to preclude damage due to the installation of any material or equipment. Unfinished work shall be temporarily protected from unsafe conditions and damage.

C. Sequencing and Scheduling: Coordinate the scheduling of equipment and material installations with all other affected trades to avoid conflicts. If, during the course of construction, conditions are discovered which adversely affect the mechanical work, immediately notify the Owner's Representative before proceeding. Advise other trades of openings required in their work for the subsequent installation of mechanical work or equipment.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 INSPECTION

A. All work and materials shall be subject at all times to inspection by the Owner's Representative and by the agencies having jurisdiction.

B. Any work or materials found to be damaged or defective or not conforming to the requirements of the Drawings or Specifications, or to the approved finish aesthetic appearance of the job, shall be removed and replaced as directed by the Owner's Representative.

1.12 ELECTRICAL REQUIREMENTS

A. All electrical work, equipment, wiring, devices, and components shall comply with the requirements of local and national electrical codes and with Division 24, 25, 26.

B. All electrical equipment, devices, and components that are tested by Underwriters Laboratories, Inc. shall be UL listed and shall bear a UL label.

C. Unless otherwise indicated on the electrical drawings, all mechanical equipment motors and controls shall be furnished, set in place, and wired in accordance with the following schedule. (Carefully coordinate all work with Divisions 24, 25, and 26.) Refer to Divisions 24, 25, and 26 for motor characteristics and motor controls.

	FURNISHED UNDER DIVISION	SET IN PLACE BY DIVISION	LINE VOLTAGE POWER UNDER DIVISION	MECH CONTROL
Equipment Motors	21,22,23	21,22,23	26	21,22,23
VFD Starters: a. Automatically controlled	26	26	26	21,22,23
b. In packaged equipment	21,22,23	21,22,23	26	21,22,23
Magnetic Motor Starters: a. Automatically controlled	26	26	26	21,22,23
b. Manually controlled	26	26	26	21,22,23
c. In packaged equipment	21,22,23	21,22,23	26	21,22,23
d. Disconnect switches, manual motor starters, thermal overload switches not provided with starter	26	26	26	--
e. Control relays, transformers, time clocks, thermostats, motor valves, float controls, damper motors, EP and PE switches and other miscellaneous Division 22 and 23 controls	21,22,23	21,22,23	26	21,22,23

D. Where Drawings clearly and explicitly differ from preceding paragraphs, Drawings have precedence.

E. Factory wired assemblies and panels shall be prewired to numbered terminal strips for connection to field wiring.

1.13 USE OF HEATING SYSTEMS DURING CONSTRUCTION

A. The Contractor is free to use or operate the heating system, provided the operation is approved in writing by the Owner's Representative. Operation of the air delivery system during construction shall only be done with specified filters properly installed.

B. When construction is complete, the Contractor shall install new filters at no additional expense to the Owner. The Contractor shall pay for all energy used until acceptance of the building.

1.14 GUARANTEE

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

B. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within a period one year form the date of final acceptance of work, unless a longer period is specified. The Owner's Representative will give notice of observed defects with reasonable promptness.

1.15 OPERATING AND MAINTENANCE DATA

A. The Contractor shall prepare operating and maintenance instructions containing information to operate, prolong service life or replace parts of the work. Operating and maintenance data shall specifically include:

1. List of all contractors' and subcontractors' names, addresses, and telephone numbers.
2. List of all equipment and material manufacturers' local representatives and suppliers and their addresses and telephone numbers.
3. Pipe and duct identification schedules.
4. Nameplate directory with a list of all equipment indicating designation, location of equipment, manufacturers' name, model number, serial number, electrical characteristics, primary control switch location and normal position of switch.
5. Valve directory indicating valve number, size, location, function, service, type, and normal position.
6. Boiler factory start-up testing report.
7. Air and hydronic test and balance report.

B. Equipment Literature: For all equipment, fixtures, devices, valves and specialties, provide the following:

1. Manufacturer's data sheets and cut sheets.
2. Model and serial numbers.
3. Capacity curves, charts and calculations.
4. Electrical characteristics.
5. Replacement parts list.
6. As-built equipment piping diagrams.
7. As-built equipment wiring diagrams.
8. Manufacturer's instructions for operation and maintenance.
9. Completely mark out on all literature sheets all non-applicable items.
10. Where piping and wiring diagrams are not available from the manufacturer, they shall be produced by the Contractor.
11. Literature shall be grouped together by system, i.e., plumbing, heat generation, etc. For each system section, the Contractor shall produce and include a basic system written narrative description. Each narrative shall be comprised of the following:

    a. Brief system description, including sequence of operation.
    b. Basic system function discussion, including any interaction with other systems or components.
    c. Primary system preventive maintenance procedures.
    d. How to isolate all major components.
    e. How to drain, fill, and vent liquid system.
    f. How to drain, clean, and refill all tanks, pumps, and tube bundles.
    g. How to clean coils and change air filters for air systems.
    h. Emergency shutdown procedures.

C. System Schematic Drawings:

1. The Contractor shall produce and include in the maintenance manuals, simplified schematic drawings of the mechanical systems, specifically including, but not necessarily restricted to, the following systems:

   a. Hydronic heating systems.
   b. Ventilation and exhaust systems.
   c. Domestic water systems.
   d. HVAC controls systems.

2. Schematic drawings shall: Show in simplified form, major equipment and equipment components, control dampers, control valves and valves or devices used during normal system operation, maintenance work or emergency functions.

   a. Show the primary flow paths for air and hydronic systems.
   b. Reference all shown equipment, devices, ducts, zones, controls devises, piping and valves by the designations and identification tags listed in the valve directory, nameplate directory, duct schedule and pipe coding schedules.

D. Master Maintenance Schedule: List each item of equipment requiring inspection and maintenance, showing component maintenance required and the intervals when such inspection and maintenance shall be performed (daily, weekly, monthly, semi-annually, etc.). For each item, reference the page within the maintenance manual where detailed manufacturer's maintenance instructions can be found.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be those of major and reputable manufacturers with ability to render competent and thorough service through local organizations and expeditiously to provide spare parts.

B. In addition to material and equipment specified, also provide incidental materials required to effect complete installation. Such incidental materials include solders, tapes, caulkings, mastics, gaskets, etc.

C. Mixes, Compounds, Dopes, Tapes and Fluxes: All mixes, compounds, dopes, tapes and fluxes shall be fresh, highest quality, free of contaminants, of the type and grade suitable for the intended use in each case. Where more than one type of mix, etc. is specified for the same service, select one type; however, state which type is proposed for use in the submittal material and in no case more than one type is to be used in a specific mechanical system. Where two or more units of the same mix, etc., are required, provide products of a single manufacturer. Provide mixes, etc., bearing approval stamps wherever standards have been established. Comply with governing regulations and industry standards for selections, and with manufacturers’ recommendations where applicable.

D. Valves, piping specialties, and escutcheons and access panels to be of same manufacturer throughout installation even though they may be specified in different Divisions of these specifications.

E. All materials and equipment shall be free of asbestos. Mixes, fluxes, and solders shall be free of lead. Submit certification no asbestos or lead based materials have been used or installed.

F. Provide all special tools and extra materials required for maintenance of installed equipment as follows:

1. Supply two 12-ounce containers of packing lubricant and cartridge style grease gun such as controls system tools and grease guns.
2. Furnish two packing kits for each size valve, two loose keys for outside hose bibs and two[pump seals for each pump model.
3. Furnish two sets of belts for each fan.
4. Furnish one additional set of filters for each unit.
5. Furnish one set of wrenches for disassembly of plate type heat exchangers.
6. Furnish 1 container of lithium bromide and inhibitors or ammonia.

2.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be new, unused, and delivered to the job site packed in their original containers.

B. All materials shall be delivered free of damage or defects.

C. Provide adequate storage facilities at the job site to protect materials from damage or corrosion.

D. Protect material, equipment, and apparatus provided under this Division from damage, water, dust, etc., both in storage and installed until final completion has been filed. Materials, equipment, or apparatus damaged because of improper storage or protection will be rejected and must be removed from site.

E. Piping, ductwork and all similar equipment shall be capped or protected during storage and installation to protect from construction debris and dust contamination.

PART 3 - EXECUTION

3.01 PREPARATION

A. The Contractor shall lay out all work in advance of construction and shall determine the correct location and placement of all material and equipment.

B. Schedule all work in coordination with that of other trades in order to avoid delays in construction and unnecessary cutting and patching.

3.02 INSTALLATION

A. All work shall be installed neatly and in accordance with the best practices in the trade.

B. Workmanship must be of highest quality, done by persons especially skilled at assigned tasks, resulting in neat, clean, and well-done installations consistent with best practices of trades.

C. Repair or replace materials and parts of premises that become damaged as a result of installation of work of this Division. Remove replaced parts from the premises.

D. Ensure installation is performed per the manufacturer's instructions.

3.03 OPERATING AND MAINTENANCE INSTRUCTION

A. Mechanical Instruction: The Contractor shall provide a minimum of 80 hours of instruction on the operation and maintenance of all mechanical systems to maintenance personnel.

B. Instruction shall be performed by a qualified technician.

C. Instruction of major pieces of equipment shall be given by a factory certified representative.

D. The instruction shall consist of both a "classroom" period and a "field" period.

E. The classroom portion shall consist of a brief discussion of each piece of equipment, using the maintenance manual as a guide, and a general preventive maintenance discussion of system as a whole; e.g., discuss procedure for maintaining proper glycol heat transfer solution mixture, etc.

F. The field portion shall consist of a building walk-through to physically locate and examine each piece of equipment previously discussed. At that time, the main points discussed during the classroom portion shall be recovered while pointing out the specific grease fitting or valve, etc.

G. Certification: The Contractor shall submit, prior to or at the time of Substantial Completion and before the Owner will accept responsibility for maintenance and operation of the facility, certification that instructions of maintenance and operation procedures have been given to the Owner's Representative responsible for the maintenance and operation of the facility.

1. The certification shall indicate the name and be affixed with the signature(s) of the person(s) receiving the instructions, the dates of instruction, and the names of the Contractor or subcontractor giving the instructions, and shall list the appropriate areas of instruction. Until these requirements are met, the Contractor shall provide at least one maintenance mechanic, acceptable to the Owner's Representative, to operate and maintain the facility's system(s).

3.04 STARTUP / DEMONSTRATION (as specified in Division 01):

A. Provide the services of a factory trained technician for the start-up and testing of the following equipment:
1. Ventilation fans.
2. HVAC building controls.

B. Prepare and submit complete startup testing and demonstration plans 30 days prior to schedule test, startup, or demonstration date. All mechanical systems shall be demonstrated for proper operation. The demonstration plan shall clearly identify each system and piece of equipment and the proposed demonstration.

C. Following successful testing and startup, submit certifications that the equipment and/or systems are operating properly.

END OF SECTION

SECTION 230548 – MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Bases.
   2. Vibration isolators.
   3. Seismic Restraints.
   4. Duct attenuators.
   5. Ductwork lagging.

1.03 REFERENCES

A. Air Movement and Control Association International, Inc.:

   1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

B. American National Standards Institute:

   1. ANSI S1.4 - Sound Level Meters.

C. American Society of Heating, Refrigerating and:

   1. ASHRAE Handbook - HVAC Applications.

D. American Society for Testing and Materials:

   1. ASTM C94 - Standard Specifications for Ready-Mixed Concrete

E. Sheet Metal and Air Conditioning Contractors':

   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
   2. SMACNA – Seismic Restraint Manual.

1.04 PERFORMANCE REQUIREMENTS

A. General:

1. Provide resilient earthquake restraints with suitable structural support for all vibration isolated equipment and piping as specified herein and shown on the drawings and in the vibration isolation schedule.
2. Restraints shall be attached to structural members capable of withstanding the design dynamic load specified below.
3. Contractor shall be responsible for ensuring that the dynamic load capacity of the attachment bolts and supporting structure is greater than or equal to the capacity of the seismic restraint.
4. Contractor shall also coordinate the size of concrete piers and housekeeping pads to ensure adequate room for the isolators and the restraints.
5. Design of the seismic restraints shall be stamped and signed by a registered civil or structural engineer.
6. Design, Select and size equipment, braces, supports and anchors.
7. Accommodate vibration and thermal movement.
8. Restraint to meet IBC requirements.

B. Work under this section shall include furnishing all labor, material, tools, and equipment necessary for the complete installation of all vibration isolation and seismic restraint for mechanical equipment, piping, ductwork, and stacks as specified and shown. Methods and materials specified in this section are minimum requirements and shall not excuse the Contractor from the responsibility of meeting the criteria specified. All changes and additions required to meet the criteria shall be made without cost to the owner. Peak vibration velocities measured on the bearing caps of rotating equipment shall not exceed 0.08 ins/sec when the equipment is running at its operating speed.

C. To qualify for approval, manufacturer shall certify in writing that he has the required engineering and testing facilities, and registered engineering personnel.

D. A single manufacturer shall furnish all isolation products including steel bases and inertia base forms. Exceptions: Canvas or lead vinyl duct connections, and concrete in inertial bases. Also excepted is the provision of spring isolators installed as an integral part of equipment mounted within cabinets fabricated by the equipment manufacturer, e.g., internally isolated air handling units. Notwithstanding, all of the isolators shall conform to the product requirements of these specifications.

E. The manufacturer is responsible for the following:

1. Selecting vibration isolators and seismic control devices meeting Contract Document requirements.
2. Furnishing shop drawings.
3. Coordinating selection of piping supports with equipment supports to maintain uniformly efficient isolation throughout each system, while accommodating vibration, expansion, and contraction, without creating excessive stresses and objectionable noises at equipment connections, ductwork, or in piping.
4. Reviewing equipment manufacturer's literature and ensuring that procedures for setting and adjusting all isolation devices are in accord with recommendations.

F. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.

G. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.

H. Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook, HVAC Applications.

Mechanical Spaces	OSHA

1.05 SUBMITTALS

A. Submit under the provisions of Division 01 and Section 230100 – General Mechanical Requirements.

B. Shop Drawings:

1. Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Drawings of all bases showing dimensions, center of gravity of the equipment, individual isolators for each support point, details of mounting brackets for isolators, location for all equipment mounting bolts and size and locations of concrete supports for the isolators.
2. Drawings and details showing the capacity, location, and arrangement of seismic restraints.

C. Product Data: Submit schedule of vibration isolator type including model number with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

D. Seismic restraint designs and/or model number.

E. Detailed calculations showing the weight distribution for each equipment support point (as calculated, not averaged), and calculations showing the loads at each isolator.

F. Size, type, load, and static deflection for each isolator.

G. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

H. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

I. All submittals shall be stamped and signed by the manufacturer’s registered professional engineer.

1.06 CLOSEOUT SUBMITTALS

A. Submit operations and maintenance data under provisions of Division 01 and Section 230100 – General Mechanical Requirements.

B. Project Record Documents: Record actual locations of hangers and seismic restraints including attachment points.

1.07 SPECIAL QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience and engineering, testing facilities, and registered engineering personnel.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

PART 2 - PRODUCTS

2.01 BASES

A. Manufacturer:

1. Mason Industries.
2. Amber Booth.

B. General:

1. All bases shall be sized to include equipment and motor without overhang.
2. Structural beam or channel members shall form the perimeter framing. Beam depth shall be at least 1/12th of the longest span. Spans less than 6 feet shall have a beam depth of 6 inches. Welded steel end closure over ends of I beams.
3. Use diagonal beams or channel braces equal to 1/2 the depth of the perimeter beam when the longest beam dimension exceeds 8 feet.
4. Provide earthquake bumpers to prevent excessive motion during starting and for earthquake bracing. Bumpers shall be installed after equipment is in operation to allow proper placement and alignment and to ensure that the bumpers are not engaged during normal system operation.
5. Motor driven equipment shall be mounted with motors on a common base of sufficient rigidity to maintain permanent alignment.
6. All bases shall have clearance of 1-1/2 inches between top of floor and underside of base.

C. Mounting Brackets MB-1: Mounting brackets sized to match vibration isolator and designed to mount directly to structural frame of mechanical equipment without the use of a separate structural steel frame.

D. Equipment Base SB-1:

1. Structural steel rectangular base with cross members to prevent twisting where longest beam dimension exceeds 6 feet.
2. Use welded steel and closure plates over the end of the I-beams for stiffness.
3. Use height-saving brackets for side mounting of isolators.
4. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
5. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

2.02 VIBRATION ISOLATORS

A. Manufacturers:

1. Mason Industries.
2. Amber Booth.

B. Steel Spring Isolators:

1. General:

a. Required types of springs and spring deflections for isolators supporting various pieces of equipment are tabulated in the vibration isolation schedule in this section.
b. All isolators for a single piece of equipment shall have approximately equal spring deflection.
c. Ends of springs shall remain parallel during deflection.
d. For each spring, provide a built-in leveling bolt.
e. Equipment must be mounted absolutely level.
f. All springs must be selected for additional 50 percent capacity to solid.
g. Provide sheet neoprene pad, Type E-1, minimum 1/4-inch thick, bonded to the underside of the baseplate or spring to serve as a noise breaker. Select pad area and durometer to achieve a static deflection between 0.04 and 0.06 inches.
h. Isolators installed out of doors shall be designed to provide restraint due to wind loads of 30 pounds per square foot, applied on surface of equipment, without failure.
i. Installed isolators shall be adjustable and easily removed for replacement.
j. Use height saving brackets as required to achieve 1 inch of clearance (+/- 1/2 inch) between base and housekeeping pad.
k. Springs must be rigidly attached, by welding or other approved means, to baseplate and top plate, except for spring hangers.
l. Springs shall be designed for minimum ratio of horizontal to vertical spring stiffness of 0.8 and minimum ratio of spring diameter to spring operating height of 0.8.
m. All floor-mounted spring isolators shall have bolt holes in bases and be anchored to structure with isolated restraining bolts. Isolate bolts from base with neoprene grommets and neoprene washers. Anchor bolts shall not compress neoprene grommets and washers more than 10 percent of normal thickness.
n. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
o. Code: Color-code springs for load carrying capacity.

2. Freestanding Springs S-1:

a. Adjustable, freestanding, open steel spring mounting with top and base plates designed to allow rigid attachment to the machinery frame and supporting structure, respectively.
b. Used for equipment that does not encounter weight removal or wind loads.
c. Neoprene pad must be located under the baseplate and not between the baseplate and spring.
d. Manufacturer:

1) Mason SLF.
2) Amber Booth.

3. Restrained Springs Type S-2:

    a. Adjustable open spring isolator, similar to Type S-1, with a frame to include vertical resilient limit stops to prevent spring extension when weight is removed.
    b. For equipment whose operating weight may differ from installed weight.
    c. Mounts shall be designed with fail-safe feature to protect against wind loads and overturning of mounts in earthquakes.
    d. Mounts shall be capable of withstanding lateral accelerations of 1g. Allow 1/2 inch clearance around vertical restraining bolts, with neoprene grommets and washer to prevent restraining bolts from short-circuiting isolation. Limit stops must be out of contact during normal operation.
    e. Manufacturer:

        1) Mason SLR.
        2) Amber Booth.

4. Spring Hanger Type SH-1:

    a. Steel box frame, open on two sides, containing an open steel spring capable of supporting twice the rated load without reaching the yield point.
    b. Spring mounted in a molded neoprene isolation bushing.
    c. Spring diameters and lower hole sizes large enough to permit hanger rod to swing through 30-degree arc before contacting hole and short-circuiting spring.
    d. Provide hole in top of box for bolting to structure.
    e. Misalignment: Capable of 20-degree hanger rod misalignment.
    f. Submittals shall include scale drawing of hanger showing misalignment capability.
    g. Manufacturer:

        1) Mason HS.
        2) Amber Booth.

5. Spring Hanger Type SH-2:

    a. Same as SH-1, but hanger shall be pre-compressed to the rated deflection to keep equipment or piping at fixed elevation during installation.
    b. Hangers shall have release mechanism to free spring after installation is complete and hanger is subjected to full load.
    c. Manufacturer:

        1) Mason PCHS.
        2) Amber Booth.

6. Thrust Restraint Type TR-1 (Compression):

    a. Horizontal thrust restraint. Two units per fan.
    b. Spring assembly with rods, clips, and miscellaneous hardware.
    c. Reinforce plenum partition with 2-1/2-inch x 2-1/2-inch x 1/4-inch channels to withstand force of thrust restraint.
    d. Install in compression.
    e. Manufacturer:

        1) Mason WBI.
        2) Amber Booth.

C. Neoprene Isolators:

1. General:

a. Neoprene rubber mounts and pads shall contain a minimum 5 percent pure neoprene rubber.
b. When used in locations that prevent easy replacement, use bridge bearing stock that contains a minimum 40 percent pure neoprene rubber.
c. Use 40 durometer unless otherwise specified or required.

2. Sheet Neoprene Pads Type E-1:

a. Pad mounting consisting of one or two layers approximately 5/16-inch-thick ribbed or waffled neoprene pads bonded to a galvanized steel load distribution plate.
b. Thickness of the load distribution plate shall be sufficient to evenly distribute (±10 percent) the load over the entire pad.
c. Pad must be furnished with sufficient area to achieve the static deflection shown in the schedule.
d. If anchoring is mandatory, provide neoprene grommets and washers to prevent anchor bolt from short circuiting isolation.
e. Manufacturer:

1) Mason MWM.
2) Amber Booth.

3. Waffle Pad Type E-2:

a. Neoprene waffle pad, top and bottom, with cork sandwiched between neoprene layers.
b. Thickness of the load distribution plate shall be sufficient to evenly distribute (±10 percent) the load over the entire pad.
c. Pad must be furnished with sufficient area to achieve the static deflection shown in the schedule.
d. If anchoring is mandatory, provide neoprene grommets and washers to prevent anchor bolt from short circuiting isolation.
e. Manufacturer:

1) Mason NK.
2) Amber Booth.

4. Neoprene Hangers Type E-3:

a. Cone-shaped elastomeric mounting made from neoprene with a box frame similar to isolator Type SH-1.
b. Hanger rod shall penetrate neoprene element and steel frame with sufficient clearance to allow it to swing through a 30-degree arc before contacting neoprene bushing at the perimeter of the hole in the frame.
c. Provide hole in the top of the box for bolting to structure.
d. Submittals shall include scale drawing of hanger showing misalignment capability.
e. Manufacturer:

1) Mason HD.

2) Amber Booth.

5. Neoprene Impregnated Washers and Bushings Type E-4:

a. Use washers and bushings to eliminate direct contact between bolt and equipment.
b. Washers shall consist of multiple-layer neoprene-impregnated duck.
c. Washer thickness should be 1/4 inch, with maximum loading not to exceed 1000 psi.
d. Bushings shall consist of neoprene-impregnated duck tube.
e. Manufacturer:

1) Washers, Mason HLW, Bushings, Mason HLB.
2) Amber Booth.

6. Pipe Anchors and Guides Type E-5:

a. Directional acoustical pipe anchors and guides for vertical piping consisting of telescopic arrangement of two sizes of steel tubing separated by minimum 1/2-inch thickness of heavy-duty neoprene and neoprene isolation material.
b. Vertical restraints shall prevent vertical travel in either direction.
c. Allowable loads on isolation materials shall not exceed 500 psi and design shall be balanced for equal resistance in any direction.
d. Manufacturer:

1) Mason ADA.
2) Amber Booth.

7. Neoprene Mounting with Captive Steel Inserts Type E-6:

a. Captive neoprene mountings shall consist of a steel housing with a captive steel insert embedded in neoprene to prevent contact between the housing and the central threaded insert. Bonded assemblies without mechanical interlocks are not acceptable.
b. All mountings shall have at minimum 1.0 horizontal G ratings. All mountings shall have bolts for rigid attachment to the equipment and adequate base bolting provision. Mountings shall have a minimum static deflection of 0.15 inch.
c. Manufacturer:

1) Mason RBA, RCA, or RDA.
2) Amber Booth.

D. Flexible Connectors:

1. General:

a. Flexible connectors shall be constructed of flexible stainless steel hose and shall have stainless steel braid and carbon steel fittings. Sizes 3 inches and larger shall be flanged.
b. Connector shall be terminated at both ends with either a flange or threaded fitting.
c. Connectors shall have a minimum burst pressure of 500 psi and a recommended maximum operating pressure that is greater than the design operating pressure at the temperature of the fluid.
d. All piping shall be properly aligned prior to the installation of the flexible connectors.

e. Flexible connectors shall not be used to compensate for misalignment of the piping.
f. Manufacturer:

1) Mason Type BSS.
2) Amber Booth.

2. Flex Connector Type FC-1:

a. Neoprene connector that incorporates a 90-degree elbow turn.
b. Design shall be such as to allow relative movement between the flanges in any direction up to 0.625 inch.
c. Recommended maximum operating pressure shall be at least 150 psi at temperatures below 220 deg F.
d. Manufacturer:

1) Mason DLFL.
2) Amber Booth.

3. Flex Connector Type FC-2:

a. Neoprene connector single-sphere design for installation in a section of straight pipe.
b. Design shall be to allow relative movement between the flanges as follows:

Pipe Size	Axial Compression	Axial Elongation
Less than 2 inches	0.375 inch	0.250 inch
2.5 inches	0.500 inch	0.250 inch
3 inches	0.625 inch	0.250 inch
4 inches	0.750 inch	0.375 inch
5 inches - 6 inches	0.875 inch	0.375 inch
over 7 inches	1.000 inch	0.625 inch

c. Recommended maximum operating pressure shall be at least 150 psi at temperatures below 220 deg F.
d. Manufacturer:

1) Mason MFEJ.
2) Amber Booth.

E. Felt and Neoprene Pipe Collars:

1. Cushion Sleeve C-1:

a. A felt or neoprene pad of minimum 1/4-inch thickness which has been treated to resist moisture, abrasion, and temperature and to repel vermin which can be used in conjunction with hangers, pipe clamps and rolls to act as a noise and vibration isolator between piping and its supporting or suspension system.
b. Sleeve shall be split or hinged and shall possess an exterior metal shell to prevent crushing during installation.
c. Manufacturer:

1) Stoneman Trisolator.

2. Pipe Penetrations C-2:

    a. Pipe to wall or floor closures shall be modular, interlocking synthetic rubber seals shaped to continuously fill the annular space between the pipe and the wall or floor opening.
    b. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut.
    c. Tightening the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and the wall or floor opening.
    d. Manufacturer:

        1) Link-Seal, manufactured by Thunderline Co.
        2) Advanced Products & Systems, Innerlynx.

3. Pipe Penetrations C-3:

    a. Pipe to wall or floor closures shall be mechanical, interlocking rubber links working as a fire stop to continuously fill the annular space between the pipe and the wall or floor opening.
    b. Provide UL-listed intumescent formulation with up to a 2-hour fire protection rating.
    c. Links shall be loosely assembled with bolts to form a continuous rubber link around the pipe.
    d. Tightening the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight, fireproof seal between the pipe and the wall or floor opening.
    e. Manufacturer:

        1) Metraflex, MetraSeal.

2.03 SEISMIC RESTRAINTS

A. Equipment shall be fitted for the seismic control per the IBC Seismic Site Class Definition of the project site. This facility is considered an essential facility.

B. Seismic Restraint Type SR-1:

1. Snubbers consisting of interlocking steel members (one attached to the equipment frame and the other attached to the building structure) restrained by neoprene rubber compounded to bridge bearing specifications.
2. Neoprene elements shall be replaceable and have minimum thickness of 3/4 inch at all points.
3. Restraints shall be installed with factory-set clearances of 1/8 inch minimum to 1/4 inch maximum between steel and neoprene elements.
4. Snubbers shall be installed after the full equipment load is placed on the vibration isolators to ensure that the equipment will not contact the snubber during normal operation.
5. Snubbers shall be capable of withstanding loads up to 4g in all directions.
6. Manufacturer:

    a. Mason Z1011.
    b. Amber Booth.

C. Seismic Restraint Type SR-2:

1. Snubbers consisting of interlocking steel members (one attached to equipment frame and the other attached to the building structure) restrained by neoprene rubber compounded to bridge bearing specifications.
2. Neoprene elements shall be replaceable and have minimum thickness of 1/4 inch at all points.
3. Restraints shall be installed with factory set clearances of 1/8 inch minimum to 1/4 inch maximum between steel and neoprene elements.
4. Snubbers shall be installed after the full equipment load is placed on the vibration isolators to ensure that the equipment will not contact the snubber during normal operation.
5. Snubbers shall be capable of withstanding loads up to 1g in all directions.
6. Manufacturer:

    a. Mason Z1225.
    b. Amber Booth.

D. Seismic Restraint Type SR-3:

1. Slack cables rigidly attached to suspended equipment or piping.
2. Attachment to structure shall include an interlocking steel element with a minimum 1/4-inch-thick neoprene pad between the interlocking steel members.
3. Cable shall be sized to accommodate dynamic loads up to 1g in all directions without failure.
4. Cables shall have 1/4-inch slack during normal operation of equipment and shall not compromise the efficiency of the vibration isolation hangers.

E. Seismic Housekeeping Pad Anchor, Type PA-1:

1. Seismic housekeeping pad anchors shall be installed on all housekeeping pads. Manufacturer shall size and select pad anchors and calculations shall be submitted and stamped by a registered professional civil or structural engineer.
2. Manufacturer:

    a. Mason HPA.
    b. Amber Booth.

2.04 DUCT ATTENUATORS

A. Manufacturers:

1. IAC.
2. Dynasonic.
3. VAW Systems.

B. Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Tubular Configuration: inner casing and liner, splitters with radius nose and contoured tails, diameter and length as indicated on drawings.

D. Rectangular Configuration: lined splitters with radius nose and contoured tails, modular, size as indicated on drawings.

E. Materials:

1. Outer Casing: Minimum 22 gage thick galvanized steel stiffened with mastic filled lock formed seams, 2 inches long, 11 gage slip joints on both ends.
2. Inner Casing and Splitters: Minimum 24 gage thick perforated galvanized steel.
3. Fill: Glass fiber or mineral wool of minimum 4 lb/cu ft density.
4. Fill Liner: 1 mil Mylar film.

2.05 DUCTWORK LAGGING

A. Acoustic Insulation: 2 inches thick, 3 to 5 lb/cu ft density glass fiber or mineral wool insulation.

B. Covering: Plaster with surface weight minimum 4 lb/sq ft.

PART 3 - EXECUTION

3.01 RUSTPROOFING

A. All vibration isolation hardware shall be designed or treated for corrosion resistance.

B. Isolators exposed to the weather shall have steel parts zinc electroplated, PVC coated, plus a coating of neoprene or bitumastic paint. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel.

C. Nuts, bolts, and washers shall be zinc electroplated.

D. Structural steel bases are to be thoroughly cleaned of welding slag, primed with zinc chromate, and finished with two coats of industrial enamel.

3.02 INSTALLATION

A. Vibration Isolators: All mechanical equipment, ductwork and piping (except fire, cast iron waste, vent, and storm drains) shall be isolated from the building structure as specified herein and tabulated in the vibration isolation schedule. No motor-driven or circulating-fluid piping shall contact the building without isolation. All isolators shall be secured to the building structure unless specifically called for in the vibration isolation specifications and schedule. Provide a balanced set of isolators for each piece of equipment. Select isolators in accordance with equipment weight distribution to allow for no less than the static deflection specified. All isolators for a single piece of equipment shall have approximately equal spring deflection. A minimum of four isolators per unit is required unless otherwise indicated. The isolator adjusting bolt must be mounted vertically in the center of the spring. Housing must have a rubber grommet in the top allowing a minimum of 1/4 inch between the grommet and the adjustable bolt. Use the type of isolator mounting base and seismic restraints that is indicated in the vibration isolation schedule. Equipment must be mounted absolutely level. Each isolator must be numbered and color-coded to show location. Code and color shall be marked on the plans, on

each equipment isolator, and on each base to ensure proper placement. All isolators shall be clearly stamped or marked to show undeflected height and static deflection so that after the installation and adjustment, deflection under load may be verified to ensure loading is within specified range and isolation is being attained.

B. Piping: All piping carrying circulating fluids or pumped gases shall be isolated from the building structure with vibration isolators as specified in the vibration isolation schedule. Piping shall not penetrate floating floors or vibration isolated ceilings unless specifically called for in the drawings. Use Type C-2 or C-3 isolators for all piping that passes through the mechanical room floor, walls, or ceiling. The inside diameter of each wall or floor opening shall be sized as recommended by the manufacturer to fit the pipe, isolator and assure a watertight joint. A flexible neoprene connector type FC-1 or FC-2 is required at the inlet and discharge of all floor supported pumps. Flexible neoprene connections are also required at the connections to the chillers and cooling towers. Horizontally suspended piping shall be suspended from massive structural beams rather than slab diaphragms wherever possible. Do not support vibration isolated piping along with non-isolated piping on a common trapeze. Steel spring hanger boxes shall be rigidly mounted to the supporting structure--not located in the middle of the hanger rod. Rigid pipe anchors are not permitted in vibration isolated piping circuits. When pipe anchors are required, use Type E-5. Use Type SH hangers at top of pipe riser for vertical pipe risers greater than 30 feet in height. Unless otherwise indicated on drawings, support and anchor with Type E-5 pipe clamps only at mid-level. Provide Type E-5 guides at other levels. Seismic restraints for vibration isolated piping shall be designed to restrict excessive lateral, vertical, and longitudinal motion without providing support of the piping during normal operation. These restraints shall not make rigid contact between piping and the building structure. Details of the seismic restraints must be included in the submittals. Design shall be approved and stamped by a registered civil or structural engineer.

C. Ductwork: Ductwork shall be constructed in accordance with applicable SMACNA standards. Flexible connections shall be provided between all fans and connecting ductwork. Support the duct just prior to or following the flexible connector to ensure proper alignment and to avoid binding the connector. Isolate duct penetrations of the floor, walls, and ceiling of all mechanical rooms as follows:

1. The hole in the floor, wall, or ceiling should be oversized so as to allow a 0.5- to 0.75-inch gap on each side of the duct. An 18 gauge sheet metal sleeve covering the entire perimeter of the hole should be plastered to the wall, ceiling, or floor to ensure an air-tight seal. If the duct penetrates a double wall, separate sleeves should be used on each side of the wall so as to have no direct connection between the walls.
2. The gap between the penetrating duct and sleeve should be packed with fiber insulation and sealed on both outer sides with a resilient acoustical sealant. Provide fire-rated insulation and sealants when penetrating rated walls or floors.

D. Support duct attenuators independent of ductwork.

E. Install cross-talk silencers in wall. Caulk wall penetrations.

F. Lag ductwork, where indicated by wrapping with insulation and covering. Apply covering to be airtight. Do not attach covering rigidly to ductwork.

G. Attach ductwork to acoustic louvers with flexible duct connections.

H. Install isolation for motor driven equipment.

I. Bases: Set steel bases for 1 inch of clearance between housekeeping pad and base.

J. Adjust equipment level.

K. Install spring hangers without binding.

L. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

M. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

N. Provide pairs of horizontal limit springs on fans with more than 6.0-inch static pressure, and on hanger-supported, horizontally mounted axial fans.

O. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05-inch maximum clearance. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.

P. Support piping connections to isolated equipment resiliently as follows:

1. Up to 4-Inch Diameter: First three points of support.
2. 5 to 8-Inch Diameter: First four points of support.
3. 10-Inch Diameter and Over: First six points of support.
4. Select three hangers closest to vibration source for minimum 1.0-inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0-inch static deflection or 1/2 the static deflection of isolated equipment.

3.03 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

3.04 SCHEDULES

A. PIPE ISOLATION SCHEDULE

Pipe Size (Inches)	Minimum Isolated Distance from Equipment
1	120 diameters
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters
10	54 diameters
12	50 diameters
16	45 diameters
24	38 diameters

B. EQUIPMENT ISOLATION SCHEDULE

			ON GRADE MIN				ABOVE GRADE MIN			
Equipment	Note	R.P.M.	Base	Isolator	Static Defn (Ins)	Seismic Restr't	Base	Isolator	Static Defn (Ins)	Seismic Restr't
Ducts	(1)	-	-	-	-	-	-	E-3	-	SR-3
Fans (floor mounted and internally spring isolated	(2) (3)	500-750 751-1000 1001-1200 Above 1200	-	-	-	-	SB-1 SB-1 SB-1 SB-1	S-1 S-1 S-1 S-1	3.0 2.5 1.5 1.0	SR-1 SR-1 SR-1 SR-1
Piping (Supported)	(4) (5)	Over 2 inch dia uninsulated2 inch dia & less	- -	S-2 C-1	1.0 0.1	SR-2 -	MB-1 -	S-2 C-1	1.0 0.1	SR-2 -
Piping (Suspended)	(4)	Over 2 inch dia 2 inch dia & less	Not Applicable				- -	SH-2 C-1	1.0 0.1	SR-3 -
Unit Heaters		All	-	-	-	-	-	SH-1	1.0	SR-3
Pumps	(6)						IB-1	S-1	1.0	SR-1

Notes:

1. All ductwork within the mechanical room and extending for a distance no less than 40 feet from the vibration isolated equipment shall be isolated with a static deflection of 0.75 inches. If additional isolators are required, use isolators with a static deflection no less than 0.25 inches.
2. Fans with speeds less than 700 RPM are not recommended for installation above grade.
3. Thrust restraints type TR-1 must be installed on fans developing a total static pressure of 2 inches and above and on fans whose isolator deflections exceeds 2 inches.
4. Piping shall be supported or suspended on steel spring isolators in the mechanical equipment room and for a distance of 40 feet from a pump or spring isolated equipment. In other cases, support or suspension shall have a neoprene of felt pad element between the pipe and its attachment to the structure.
5. Piping connected to pumps shall be connected with pipe FC-1 or FC-2 flexible connectors.
6. Pumps over 5 hp located above grade shall be mounted on inertia bases as indicated.

END OF SECTION

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SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe markers.
   5. Ceiling tacks.
   6. Labels.
   7. Lockout devices.

1.03 REFERENCES

A. American Society of Mechanical Engineers:

   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS

A. Section 013300 “Submittal Procedures”: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Manufacturers: Seton Identification Products or approved substitute.

B. Product Description: Laminated three-layer plastic with engraved letters on light contrasting background color.

C. Plate minimum size 3/4 inch x 2-1/2 inches.

2.02 TAGS

A. Plastic Tags:

1. Manufacturers: Seton Identification Products or equal.

2. Laminated three-layer plastic with engraved letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:

1. Manufacturers: Seton Identification Products or equal.

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers: Seton Identification Products or equal.
2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.03 STENCILS

A. Manufacturers: Seton Identification Products or equal.

B. Furnish materials in accordance with State of Alaska standards.

C. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2-inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
4. Ductwork and Equipment: 1-3/4 inches high letters.

D. Stencil Paint: As specified in Section 099123 “Interior Painting”, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.04 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers: Seton Identification Products or equal.

2. Factory-fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers: Seton Identification Products or equal.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

2.05 LABELS

A. Manufacturers: Seton Identification Products or equal.

B. Description: Aluminum, size 1.9 by 0.75 inches, adhesive backed with printed identification.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 099123 “Interior Painting”, for stencil painting.

3.02 INSTALLATION

A. Apply stencil painting in accordance with Section 099123 “Interior Painting”,.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. For pipe markers, provide complete wraps of adhesive direction arrow tape around both ends of marker.

F. Install tags using corrosion resistant chain. Number tags consecutively by location.

G. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

H. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

I. Identify control panels and major control components outside panels with plastic nameplates.

J. Identify valves in main and branch piping with tags showing service and valve number.

K. Valve tags to indicate whether valve is normally open or normally closed (NO or NC). Number tags consecutively by location.

L. Identify air terminal units and radiator valves with numbered tags.

M. Tag automatic controls, instruments, and relays. Key to control schematic.

N. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch in diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

O. Identify ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

P. Provide ceiling tacks to locate valves, dampers equipment, and other maintained devices above T-bar type panel ceilings.

1. Locate tack on panel, closest to the device.
2. For equipment requiring maintenance, such as VAV boxes, locate ceiling tack at access location.
3. Write on the tack with permanent marker an identifier such as the valve or equipment tag.

3.03 SCHEDULES

IDENTIFICATION

Common abbreviations are shown; submit proposed abbreviations for other systems as needed.

FOS	Fuel Oil Supply
FOR	Fuel Oil Return
EXH	Engine Exhaust

END OF SECTION

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SECTION 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Testing, adjusting, and balancing of air systems.
   2. Measurement of final operating condition of HVAC systems.
   3. Sound measurement of equipment operating conditions.
   4. Vibration measurement of equipment operating conditions.

1.03 REFERENCES

A. Associated Air Balance Council:

   1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

   1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:

   1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.04 SUBMITTALS

A. Section 013300 “Submittal Procedures”: Submittal procedures.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Furnish reports in soft cover, letter size, three-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.05 CLOSEOUT SUBMITTALS

A. Section 017700 “Closeout Procedures”: Closeout procedures.

B. Project Record Documents: Record actual locations of balancing valves and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance.

1.07 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience.

1.08 SEQUENCING

A. Section 017300 - Execution: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 013100 “Project Management and Coordination”: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.
4. Duct systems are clean of debris.
5. Fans are rotating correctly.
6. Access doors are closed and duct end caps are in place.
7. Air outlets are installed and connected.
8. Duct system leakage is minimized.
9. Service and balancing valves are open.

3.02 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.03 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 ADJUSTING

A. Section 017700 “Closeout Procedures”: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

J. At modulating damper locations, take measurements and balance at extreme conditions.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near building entries.

3.06 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Heating Terminal Units.
   2. Fans.

B. Report Forms:

   1. Title Page:

      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.
      g. Project Engineer.
      h. Project Contractor.

i. Project altitude.
j. Report date.

2. Summary Comments:

a. Design versus final performance.
b. Notable characteristics of system.
c. Description of systems operation sequence.
d. Summary of outdoor and exhaust flows to indicate building pressurization.
e. Nomenclature used throughout report.
f. Test conditions.

3. Instrument List:

a. Instrument.
b. Manufacturer.
c. Model number.
d. Serial number.
e. Range.
f. Calibration date.

4. Electric Motors:

a. Manufacturer.
b. Model/Frame.
c. HP/BHP and kW.
d. Phase, voltage, amperage; nameplate, actual, no load.
e. RPM.
f. Service factor.
g. Starter size, rating, heater elements.
h. Sheave Make/Size/Bore.

5. V-Belt Drive:

a. Identification/location.
b. Required driven RPM.
c. Driven sheave, diameter and RPM.
d. Belt, size and quantity.
e. Motor sheave diameter and RPM.
f. Center to center distance, maximum, minimum, and actual.

6. Unit Heater and Convection Heater Data:

a. Manufacturer.
b. Identification/number.
c. Location.
d. Model number.
e. Size.
f. Air flow, design and actual.
g. Entering air temperature, design and actual.
h. Leaving air temperature, design and actual.

7. Air Moving Equipment:

    a. Location.
    b. Manufacturer.
    c. Model number.
    d. Serial number.
    e. Arrangement/Class/Discharge.
    f. Air flow, specified and actual.
    g. Return air flow, specified and actual.
    h. Outside air flow, specified and actual.
    i. Total static pressure (total external), specified and actual.
    j. Inlet pressure.
    k. Discharge pressure.
    l. Sheave Make/Size/Bore.
    m. Number of Belts/Make/Size.
    n. Fan RPM.

8. Return Air/Outside Air Data:

    a. Identification/location.
    b. Design air flow.
    c. Actual air flow.
    d. Design return air flow.
    e. Actual return air flow.
    f. Design outside air flow.
    g. Actual outside air flow.
    h. Return air temperature.
    i. Outside air temperature.
    j. Required mixed air temperature.
    k. Actual mixed air temperature.
    l. Design outside/return air ratio.
    m. Actual outside/return air ratio.

9. Exhaust Fan Data:

    a. Location.
    b. Manufacturer.
    c. Model number.
    d. Serial number.
    e. Air flow, specified and actual.
    f. Total static pressure (total external), specified and actual.
    g. Inlet pressure.
    h. Discharge pressure.
    i. Sheave Make/Size/Bore.
    j. Number of Belts/Make/Size.
    k. Fan RPM.

10. Duct Leak Test:

    a. Description of ductwork under test.
    b. Duct design operating pressure.
    c. Duct design test static pressure.

d. Duct capacity, air flow.
e. Maximum allowable leakage duct capacity times leak factor.
f. Test Apparatus:

1) Blower.
2) Orifice, tube size.
3) Orifice size.
4) Calibrated.

g. Test static pressure.
h. Test orifice differential pressure.
i. Leakage.

11. Sound Level Report:

a. Location.
b. Octave bands - equipment off.
c. Octave bands - equipment on.
d. RC level - equipment on.

12. Vibration Test:

a. Location of points:

1) Fan bearing, drive end.
2) Fan bearing, opposite end.
3) Motor bearing, center (when applicable).
4) Motor bearing, drive end.
5) Motor bearing, opposite end.
6) Casing (bottom or top).
7) Casing (side).
8) Duct after flexible connection (discharge).
9) Duct after flexible connection (suction).

b. Test Readings:

1) Horizontal, velocity and displacement.
2) Vertical, velocity and displacement.
3) Axial, velocity and displacement.

c. Normally acceptable readings, velocity and acceleration.
d. Unusual conditions at time of test.
e. Vibration source (when non-complying).

END OF SECTION

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SECTION 230700 – HVAC INSULATION

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. HVAC equipment insulation, jackets and accessories.
   2. Ductwork insulation, duct liner, jackets, and accessories.

1.03 REFERENCES

A. ASTM International:

   1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
   4. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
   5. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
   6. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   7. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   8. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
   9. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   10. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
   11. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
   12. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
   13. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   14. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

15. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
16. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
17. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
18. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
19. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
2. UL 1978 - Standard for Safety for Grease Ducts.

1.04 SUBMITTALS

A. Section 013300 "Submittal Procedures": Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.08 WARRANTY

A. Section 017700 “Closeout Procedures”: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for manmade fiber.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:

1. CertainTeed.
2. Knauf.
3. Johns Manville.
4. Owens-Corning.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:

1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.

C. Manufacturers for Polyisocyanurate Foam Insulation Products:

1. Dow Chemical Company.

D. Manufacturers for Extruded Polystyrene Insulation Products:

1. Dow Chemical Company.

2.02 EQUIPMENT INSULATION

A. TYPE D-1: ASTM C612; glass fiber, rigid board, noncombustible with factory applied aluminum foil jacket.

1. Thermal Conductivity: 0.24 at 75 deg F.

2. Operating Temperature Range: 0 to 450 deg F.
3. Density: 3.0 pound per cubic foot.
4. Jacket Temperature Limit: minus 20 to 150 deg F.

B. TYPE D-2: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket.

1. Thermal Conductivity: 0.27 at 75 deg F.
2. Operating Temperature Range: 0 to 650 deg F.
3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 deg F.

C. TYPE D-3: ASTM C612; glass fiber, semi-rigid board, noncombustible.

1. Thermal Conductivity: 0.23 at 75 deg F.
2. Maximum Operating Temperature: 850 deg F.
3. Density: 3.0 pound per cubic foot.

2.03 EQUIPMENT INSULATION JACKETS

A. Aluminum Equipment Jacket:

1. ASTM B209.
2. Thickness: 0.016 inch thick sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

B. Canvas Equipment Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

C. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

2.04 Type E-1: HYDROUS CALCIUM SILICATE

A. Calcium Silicate Block and Pipe Thermal Insulation: ASTM C533, Type II for use on surfaces up to 1200 deg F.

B. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

C. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement:

1. ASTM C449.

2.05 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Adhesives: Compatible with insulation.

2.06 DUCTWORK INSULATION

A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.

1. Thermal Conductivity: 0.29 at 75 deg F.
2. Maximum Operating Temperature: 250 deg F.
3. Density: 1.0 pound per cubic foot.

B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied metalized polypropylene scrim kraft facing meeting ASTM C1136, Type II.

1. Thermal Conductivity: 0.24 at 75 deg.
2. Density: 6.0 pound per cubic foot.

2.07 DUCTWORK INSULATION JACKETS

A. Aluminum Duct Jacket:

1. ASTM B209.
2. Thickness: 0.016 inch thick sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

B. Vapor Retarder Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film; 0.0032 inch vinyl.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.
3. Secure with pressure sensitive tape.

C. Canvas Duct Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

2.08 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof type.

D. Liner Fasteners: Galvanized steel, welded with integral press-on head.

E. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

F. Lagging Adhesive: Fire resistive to ASTM E84.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 013100 “Project Management and Coordination”: Coordination and project conditions.

B. Verify equipment and ductwork has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

D. Prepare surfaces and install insulation, jacketing, and accessories in accordance with manufacturer’s recommendations, building codes, and industry standards.

3.02 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.

E. Cover glass fiber insulation with aluminum jacket.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

H. Prepare equipment insulation for finish painting. Refer to Section 099123 “Interior Painting”.

3.03 INSTALLATION - DUCTWORK SYSTEMS

A. Duct dimensions indicated on Drawings are finished inside dimensions.

B. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces below 10 feet above finished floor: Finish with aluminum jacket.

E. External Glass Fiber Duct Insulation:

1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

F. External Elastomeric Duct Insulation:

1. Adhere to clean oil-free surfaces with full coverage of adhesive.
2. Seal seams and butt joints with manufacturer’s recommended adhesive.
3. When application requires multiple layers, apply with joints staggered.
4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
5. Lift ductwork off trapeze hangers and insert spacers.

G. Prepare duct insulation for finish painting. Refer to Section 099123 “Interior Painting”.

3.04 SCHEDULES

A. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Combustion Air	D-2	1.5
Outside Air Intake	D-2	1.5
Ducts Within 10 feet (3 m) of Exterior Openings	D-1, D-2	1.5

END OF SECTION

SECTION 230900 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section includes HVAC instrumentation and sequence of operation for:
   1. Exhaust Fan.
   2. Ventilation Fan.
   3. Dampers for Generator Air Exhaust and Supply.
   4. Unit Heaters.
   5. Convection Heaters.

1.03 REFERENCES

A. National Electrical Manufacturers Association
   1. NEMA DC 3 - Residential Controls - Electrical Wall Mounted Room Thermostats.

B. National Fire Protection Association
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.04 SUBMITTALS

A. Section 013300 – "Submittal Procedures": Submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.

   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Submit flow diagrams for each control system, graphically depicting control logic.
   3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   4. Coordinate submittals with information requested in mechanical specifications.

PART 2 - PRODUCTS

2.01 THERMOSTATS

A. Manufacturers: Honeywell, Johnson Controls, or equal.

B. Electric Room Thermostats:
1. Type: NEMA DC 3, 24 volts.
2. Service: Heating.
3. Covers: Locking with set point adjustment and thermometer.

C. Line Voltage Thermostats:
1. Integral manual On/Off/Auto selector switch, single or two-pole.
2. Dead band: Maximum 2 degrees F.
3. Cover: Locking with set point adjustment and thermometer.
4. Load capacity rating.

2.02 GAS DETECTORS

A. Manufacturer: Hydro Instruments GA-180 or approved equal.

B. Provide:
1. Electrochemical Chlorine (Cl) gas sensor, with adjustable setpoint with a range of 0 to 10 ppm and 25-foot 22 AWG shielded cable and isolated 4-20mA outputs for sensors.
2. Digital alarm control panel shall be menu driven, containing push button interface and two line alpha numeric back list LCD display. Controller shall be housed in NEMA4X enclosure with visual and audible alarms. Communication shall be Modbus, RS485, with MicroSDHC internal data logging.
3. Alarm outputs shall activate external devices.
4. Alarm Horn: 90dB horn shall be located at the panel with additional horn located within the Chlorine Treatment Room.
5. Audible alarm capability.
6. Battery backup with 12 hours 2.0Ahr, 12VDC gel cell.

2.03 ELECTRIC DAMPER ACTUATORS

A. Operation: Two-position.

B. Mounting: Direct mount.

C. Stroke: 90 seconds end to end full stroke, 15 seconds return to normal for spring return.

D. Protection: Electronic stall protection.

E. Control Input: 0-10 VDC or 0-20 mADC.

F. Torque: Size for minimum 150 percent of required duty.

G. Duty cycle: rated for 65,000 cycles.

2.04 OCCUPANCY SENSOR

A. For EF-01 control, space shall be considered occupied when space lights are ON or when occupancy sensor senses motion. Refer to electrical plan and specifications for motion sensor and timing relay.

PART 3 - EXECUTION

3.01 EXHAUST FAN (EF-01):

A. The water treatment room exhaust fan (EF-01) shall be provided with a positive shut-off control damper. The unit shall be controlled using electric actuation. EF-01 positive shut-off damper shall open, and EF-01 shall operate:
   1. When the room lights are turned on by an external light switch to activate the exhaust fan before entering the room, the fan shall operate for a minimum of 20 minutes (adjustable). A timer relay shall reset fan run time when room motion sensor detects motion in the room.
   2. When the Chlorine Gas (Cl2) Detection monitor exceeds setpoints (adjustable) of 1 ppm for Cl2.

B. The minimum run time upon EF-01 activation is 20 minutes (adjustable).

C. EF-01 shall be off with a Cl2 level detection below 0.5 ppm (adjustable), when space is unoccupied, and after the minimum run time has elapsed.

D. Make-up air will be provided by a wall opening control damper, which will open whenever EF-01 is on.

E. Safety:
   1. Whenever the Cl2 concentration is above the set point (adjustable) for more than five minutes, an integral alarm shall sound from the detector, an alarm signal shall be sent to the Control System, and a horn alarm shall sound from the pumproom.

3.02 VENTILATION FAN (VF-01):

A. The pump room ventilation fan (VF-01) shall be provided with a positive shut-off control damper. The unit shall be controlled using electric actuation. VF-01 positive shut-off damper shall open and VF-01 shall operate:
   1. Whenever room temperature exceeds 75 degrees F (adjustable) and shall turn off when the space temperature reaches 65 degrees F (adjustable).

B. Relief air will be provided by a wall opening with control damper, which will open whenever VF-01 is on.

3.03 GENERATOR ROOM SUPPLY, EXHAUST & RETURN DAMPERS:

A. When Generator is not in operation:
   1. Outside Air Supply dampers shall be closed.

2. Return Air Damper shall be closed.
3. Exhaust Damper shall be closed.

B. When generator is operating:
1. Outside Air Supply dampers shall be fully open.
2. Exhaust Damper and Return Air dampers shall modulate to maintain a space temperature of 65 deg F (adjustable).
   a. Exhaust air dampers shall fail closed and return dampers shall fail open.
   b. If the room temperature rises above 80 degrees (adjustable) or below 50 degrees (adjustable) for 5 minutes, an alarm shall be generated.
   c. If the room temperature rises above 90 degrees (adjustable) or below 40 degrees (adjustable) for 5 minutes, a critical alarm shall be generated.

3.04 UNIT HEATERS (UH-01, UH-02):

A. Unit shall operate per the manufacturer controller and remote sensor based upon room temperature setpoint of 55 deg F (adjustable).
1. Room temperature below setpoint minus a deadband.
   a. Unit heater fan and electric coil shall energize
2. Room temperature rising above setpoint plus a deadband.
   a. Unit heater electric coil is de-energized
   b. Unit heater fan is de-energized.
3. The unit shall run a minimum of 5 minutes to prevent short cycling.

3.05 CONVECTION HEATERS (CH-01, CH-02, CH-03):

A. Unit shall operate per the packaged manufacturer controller and integral thermostat based upon setpoint of 55 deg F (adjustable).

3.06 FUEL SYSTEM, TANK (FT-01) ACCESSORIES:

A. Fuel tank controls are performed by manufacturer's packaged controls for fuel system monitoring and alarm sequences. Fuel system monitoring and alarm sequences shall be performed by the package Tank Monitoring System supplied with the fuel storage tank. Reference Section 231323 "Facility Fuel-Storage Tanks".

END OF SECTION

SECTION 231113 - FACILITY FUEL-OIL PIPING

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Fuel-oil pipes, tubes, and fittings.
   2. Piping specialties.

1.03 SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, and dimensions of individual components and profiles.
   2. Include, where applicable, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fuel-oil piping.

   1. Include plans, elevations sections, hangers, and supports for multiple pipes.
   2. Include details of location of anchors, alignment guides, and expansion joints and loops.
   3. Scale: 1/4 inch per foot.

C. Coordination Drawings: Plans and details, drawn to scale, on which fuel-oil piping is shown and coordinated with other installations, using input from installers of the items involved.

D. Brazing certificates.

E. Welding certificates.

F. Field quality-control reports.

   1. Startup reports for leak-detection and monitoring system

G. Warranty: For special warranty.

H. Operation and Maintenance Data: For fuel-oil equipment and accessories to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

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

C. Pipe Welding Qualifications:

1. Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code.
2. Pipe welder to have a minimum of 3 years of documented experience.

1.05 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 pipes and tubes with protective PE coating to avoid damaging the coating and to protect from direct sunlight.

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of flexible piping and related equipment that fail in materials or workmanship within specified warranty period.

1. Failures due to defective materials or workmanship for materials including piping, dispenser sumps, water-tight sump entry boots, terminations, and other end fittings.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

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. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.

C. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil piping location.

D. Fuel-Oil Valves: Comply with UL 842 and have service mark initials "WOG" permanently marked on valve body.

E. Comply with requirements of the EPA and of state and local authorities having jurisdiction.

2.02 PIPES, TUBES, AND FITTINGS

A. See "Piping Schedules" for where pipes, tubes, fittings, and joining materials are applied in various services.

B. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M, for butt and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: Asbestos free, ASME B16.20 metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
    e. Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
    f. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and Poly-Ethylene (PE).
    g. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

C. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

    a. Gasket Material: Asbestos free, ASME B16.20 metallic or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
    b. Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.

D. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
2. Flare Fittings: Comply with ASME B16.26 and SAE J513.

    a. Copper fittings with long nuts.
    b. Metal-to-metal compression seal without gasket.
    c. Dryseal threads complying with ASME B1.20.3.

2.03 PIPING SPECIALTIES

A. Metallic Flexible Connectors:

1. Listed and labeled for aboveground and underground applications by an NRTL acceptable to authorities having jurisdiction.
2. Stainless-steel bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
3. Minimum Operating Pressure: 150 psig.
4. End Connections: Socket, flanged, or threaded end to match connected piping.
5. Maximum Length: 30 inches.
6. Swivel end, 50-psig maximum operating pressure.
7. Factory-furnished anode for connection to cathodic protection.

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: 60-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Manual Air Vents:

1. Body: Bronze or Stainless Steel.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

2.04 JOINING MATERIALS

A. Joint Compound for Threaded Joints: Suitable for fuel oil.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

D. Bonding Adhesive for RTRP and RTRF: As recommended by piping and fitting manufacturer.

2.05 SPECIALTY VALVES

A. Pressure Relief Valves:

1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
2. Body: Brass, bronze, or cast steel.
3. Springs: Stainless steel, interchangeable.
4. Seat and Seal: Nitrile rubber.
5. Orifice: Stainless steel, interchangeable.
6. Factory-Applied Finish: Baked enamel.
7. Maximum Inlet Pressure: 150 psig.
8. Relief Pressure Setting: 60 psig.

B. Oil Safety Valves:

1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
2. Body: Brass, bronze, or cast steel.
3. Springs: Stainless steel.
4. Seat and Diaphragm: Nitrile rubber.
5. Orifice: Stainless steel, interchangeable.
6. Factory-Applied Finish: Baked enamel.
7. Manual override port.
8. Maximum Inlet Pressure: 60 psig.
9. Maximum Outlet Pressure: 3 psig.

C. Emergency Shutoff (Fusible) Valves:

1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
2. Single poppet valve.
3. Body: ASTM A 126, cast iron.
4. Disk: FPM.
5. Poppet Spring: Stainless steel.
6. Stem: Plated brass.
7. O-Ring: FPM.
8. Packing Nut: PTFE-coated brass.
9. Fusible link to close valve at 165 deg F.
10. Thermal relief to vent line pressure buildup due to fire.
11. Air test port.
12. Maximum Operating Pressure: 0.5 psig.

D. Anti-Siphon Valve:

1. Ductile iron, stainless steel, or aluminum body.
2. Ductile iron, stainless steel, or aluminum cap.
3. Stainless steel spring.
4. Stainless steel or aluminum plunger.
5. Viton or Nitrile seals.

2.06 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

1.01 GATE VALVES

A. Manufacturers: Nibco or equal.

B. Up To and Including 2 inches : MSS SP-80, Class 125, bronze body, bronze trim, rising stem, hand wheel, inside screw, solid wedge disc, solder or threaded ends.

C. Larger than 2 inches : MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, hand wheel, solid wedge disc, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger, mounted over 8 feet above floor.

1.02 GLOBE VALVES

A. Manufacturers: Nibco or equal.

B. Up To and Including 2 inches : MSS SP-80, Class 125, bronze body, bronze trim, hand wheel, bronze disc, solder or threaded ends.

C. Larger than 2 inches : MSS SP-85, Class 125, iron body, bronze trim, hand wheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger, mounted over 8 feet above floor.

1.03 BALL VALVES

A. Manufacturers: Nibco or equal.

B. Ball Valves: MSS SP-110, 2000 WOG, steel, one piece body, chrome-plated carbon steel ball, full port, teflon seats and seals, blow-out proof stem, lever handle threaded ends.

1.04 SWING CHECK VALVES

A. Manufacturers: Nibco or equal.

B. Up to 2 inches: MSS SP-80, Class 125, bronze body and cap, bronze swing disc, solder or threaded ends.

C. 2 inches and Larger: MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal, and seat, flanged or grooved ends.

1.05 ANTI-SIPHON VALVES

A. Manufacturers: Preferred Utilities Type A or approved equal.

B. Valve shall be of bronze construction.

1.06 FUSIBLE VALVES:

A. Fusible valves shall be brass body with fusible element in the handwheel, and shall automatically close when acted upon by heat of 165 deg F. The fusible valve shall be capable of being operated manually and shall have self-adjusting stuffing box and back seat features to prevent leaks at the valve stem. Fusible valves shall by Firomatic Model No. 300-F or equal.

1.07 FUEL FILTERS:

A. Provide and install in-line fuel filters as shown on the Drawings with replaceable cartridges capable of removing down to 10 micron particles. The filter units shall include a water sump and drainage fitting and shall be sized to match the burner or equipment fuel consumption.

1.08 PIPE HANGERS AND SUPPORTS

A. See Section 230529 “Hangers and Supports for Plumbing Piping and Equipment”.

B. Conform to NFPA 31, and ASME B31.1.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 inchCarbon steel, adjustable swivel, split ring.

D. Wall Support for Pipe 3 inchesand Smaller: Cast iron hook.

E. Vertical Support: Steel riser clamp.

F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

G. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

1.09 STRAINERS

A. Manufacturers: Watts or equal.

B. Threaded brass body for Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen.

1.10 FLEXIBLE CONNECTORS

A. Flexible Metal Hose

1. Manufacturers: Anament, Inc. #16308 or equal.
2. Type 321 stainless steel corrugated metal hose with 304 stainless steel wire braid sheath covering, close-pitch annular corrugations.
3. Rated for 125 psig working pressure 12-inch minimum live length, threaded end connections.
4. Connector shall conform to UL 567 for above and below ground fuel use.

B. Elastomeric Hose

1. Manufacturer: Aeroquip 1525 fire-resistant fuel hose or equal.
2. Elastomeric tube with brass plated steel wire reinforcement and braided refractory insulation for fire resistance.

C. Rated for 125 psig working pressure and 16 inches Hg vacuum.

2.07

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of fuel-oil piping.

B. Examine installation of fuel-burning equipment and fuel-handling and storage equipment to verify actual locations of piping connections before installing fuel-oil piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Close equipment shutoff valves before turning off fuel oil to premises or piping section.

B. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.

3.03 OUTDOOR PIPING INSTALLATION

A. Install vent pipe at a minimum slope of 2 percent downward toward fuel-oil storage tank sump.

B. Assemble and install entry boots for pipe penetrations through sump sidewalls for liquid-tight joints.

C. Install metal pipes and tubes, fittings, valves, and flexible connectors at piping connections to AST and UST.

D. Install fittings for changes in direction in rigid pipe.

E. Install system components with pressure rating equal to or greater than system operating pressure.

3.04 INDOOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 by Engineer and included on Coordination Drawings if required.

B. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction to allow for mechanical installations.

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 at a height that allows sufficient space for ceiling panel removal.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Comply with requirements for equipment specifications for roughing-in requirements.

I. Conceal pipe installations in walls, pipe spaces, or utility spaces; above ceilings; below grade or floors; and in floor channels unless indicated to be exposed to view.

J. Prohibited Locations:

1. Do not install fuel-oil piping in or through HVAC ducts and plenums, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
2. Do not install fuel-oil piping in solid walls or partitions.

K. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

L. Connect branch piping from top or side of horizontal piping.

M. Install unions in pipes NPS 2 and smaller at final connection to each piece of equipment and elsewhere as indicated. Unions are not required on flanged devices.

N. Do not use fuel-oil piping as grounding electrode.

O. Install sleeves and sleeve seals for piping penetrations of walls, ceilings, and floors.

P. Install escutcheons for piping penetrations of walls, ceilings, and floors of occupied spaces.

3.05 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe 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 unless dry seal threading is specified. Do not use Teflon tape.
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.

D. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Bevel plain ends of steel pipe.
2. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tubing" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.

G. Flared Joints: Comply with SAE J513. Tighten finger tight then use wrench according to fitting manufacturer's written instructions. Do not overtighten.

3.06 CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance.

B. Install unions, in piping NPS 2-1/2 and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.

C. Install flanges, in piping NPS 3 and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

D. Connect piping to equipment with shutoff valve and union. Install union between valve and equipment.

E. Install flexible piping connectors at final connection to burners or oil-fired appliances.

3.07 LABELING AND IDENTIFYING

A. Nameplates, pipe identification, valve tags, and signs are specified in "Identification for HVAC Piping and Equipment."

3.08 FIELD QUALITY CONTROL

A. Pressure Test Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:

1. Fuel-Oil Distribution Piping: One and one-half times maximum working pressure with Minimum 5 psig for minimum 30 minutes.
2. Suction Piping: Minimum 20 in. Hg for minimum 30 minutes.
3. Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig.

B. Inspect and test fuel-oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction. Pressure test positive pressure piping. Vacuum test negative pressure piping.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Bleed air from fuel-oil piping using manual air vents.

E. Fuel-oil piping and equipment will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.09 OUTDOOR PIPING SCHEDULE

A. Aboveground fuel-oil piping shall be one of the following:

1. NPS 2 and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

3.10 INDOOR PIPING SCHEDULE

A. Aboveground fuel-oil piping shall be one of the following:

1. NPS 1/2 to NPS 2: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.

2. NPS 2-1/2 and Larger: Steel pipe, steel fittings, and welded or flanged joints.

3.11 PIPE SUPPORT SPACING:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING MINIMUM HANGER ROD DIAMETER Inches	STEEL PIPE MINIMUM HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8

END OF SECTION

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SECTION 231323 - FACILITY ABOVEGROUND FUEL-OIL STORAGE TANKS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:

   1. Insulated, steel, fuel-oil aboveground storage tanks (ASTs).

1.03 DEFINITIONS

A. AST: Aboveground storage tank.

1.04 SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, and dimensions of individual components and profiles.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   3. Fuel-oil storage tank accessories.

B. Shop Drawings:

   1. Include plans, elevations, sections, and ballast pads and anchors, and lifting or supporting points.
   2. Indicate dimensions, components, and location and size of each field connection.
   3. Shop Drawing Scale: 1/4 inch per foot minimum.

C. Seismic Qualification Data: For ASTs, accessories, and components, from manufacturer.

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Welding certificates.

E. Field quality-control reports.

F. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-oil equipment and accessories to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. EPA Compliance: Comply with EPA and state and local authorities having jurisdiction. Include recording of fuel-oil storage tanks and monitoring of tanks.

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

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-oil storage tanks that fail in materials or workmanship within specified warranty period.

1. Storage Tanks:

a. Failures include, but are not limited to, the following when used for storage of fuel oil at temperatures not exceeding 150 deg F:

1) Structural failures including cracking, breakup, and collapse.
2) Corrosion failure including external and internal corrosion of steel tanks.

b. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design restraint and anchors for fuel-oil ASTs, and equipment, including comprehensive engineering analysis, using performance requirements and design criteria indicated.

B. Seismic Performance: Factory-installed support attachments for AST shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.02 FUEL DAY TANK (DT-1)

A. Reference Electrical Specification 263213.13 – “Diesel-Engine-Driven Generator Sets.”

2.03 FUEL STORAGE TANK (FT-1)

A. Manufacturers: Ace Tank or equal.

B. Tank: UL listed and labeled, closed double wall type, heavy gauge welded steel, cleaned and coated with coal tar epoxy, urethane, or isophthalic polyester resin. Furnish and anchor straps

and attachments, fittings, and taps for accessories and lifting lugs. Manufacturer will provide electrically isolated pipe connectors with striker plates below each opening.

C. Fill Cap: 3-inch watertight cap with cam action locking lever.

D. Tank Fittings:

1. Fill: 4-inch.
2. Vent: 2-inch, galvanized, including "T" and elbow assembly with 1/4-inch square mesh screen over inlet.
3. Suction: 1-inch anti-siphon connection to tank bottom with foot valve.
4. Return: 1-inch.
5. Gauge Fitting: 2-inch.
6. Connections: UL 567, dielectric bushings.

E. Man-way: 18-inch diameter, with cover and gasket, and extension sleeve; located at top of tank.

F. Finish: Factory painted with industrial epoxy and urethane coating with dry film thickness of 4 milsColor: white.

G. Fill Connection: Furnish fill containment assembly with capacity of not less than 15 gallons. Furnish with hinged locking cover, stainless steel hinges, handle, safety chain, and lock hasp.

H. Normal Vent: Furnish each compartment of primary tank with 2 inchupdraft venting device exhausting upward at elevation of at least 12 feetaboveground. Size vent in accordance with NFPA 30.

I. Emergency Vent: Furnish each compartment of primary tank with emergency vent sized in accordance with NFPA 30. Do not use access openings for emergency venting purposes.

J. Monitor Port: Minimum 2 inchsteel pipe with locking cap to be used for detecting leaks between primary and outer tanks.

K. Accessories:
1. Level Gage: Mechanical float activated level gage capable of indicating approximate fluid level in tank reading in feet and inches.
2. Tank Decals: Furnish warning and tank identification signs located prominently on tank following local code requirements.

2.04 TANK MONITORING SYSTEM

A. Provide UL listed tank monitoring system including sensors, wiring, and panels for detection of liquids. EBW Auto-Stik Jr. or equal.

B. Provide a system to detect the following:
1. Presence of liquid at the bottom of the annular space between the inner and outer walls of the double wall fuel oil storage tank. Sensor type EBW LS-3A or equal.
2. Presence of liquid in the surface access manhole at the tank supply and return piping connections. Sensor type EBW LS-3A or equal.
3. Presence of liquid in the overfill catchment basin. Sensor type EBW LS-3A or equal.

4. Fuel level in the fuel tank. Sensor type EBW 960 Series or pre-approved equal.
5. Sensor Alarm Console shall provide audible and visual indication of alarm condition. Franklin Electric S940 or approved equal.

C. Provide sensors suitable for a minimum ambient temperature range of -60 degrees F to 130 degrees F and rated intrinsically safe per NFPA.

D. Provide external annunciator to alarm on command from control panel at 90 percent fill level as sensed by liquid level sensor. External annunciator shall be suitable for exterior mounting. EBW 961-4501 or equal.

E. Provide sensor wiring and raceway system in accordance with manufacturer's recommendations and Electrical Sections. Junction box at tank and fittings within access box shall be explosion proof.

F. Provide control panel complete with all necessary controls relays, auxiliary contacts, and pilot lights as required to meet the control sequence and alarm as specified in Section 230900 "Instrumentation and Control for HVAC". Provide power supply transformer as necessary to energize panel.

2.05 TANK OVERFILL PREVENTOR

A. Provide overfill protection device, capable of being set at 95 percent tank capacity. Warden AST or equal.
1.

2.06 SHOP PAINTING OF AST

A. Prepare exterior steel surface of AST and tank supports.

B. Shop Cleaning: After fabrication, blast clean according to SSPC-SP 10/NACE No. 2.

C. After cleaning, remove dust or residue from cleaned surfaces.

D. If surface develops rust before prime coat is applied, repeat surface preparation.

E. Apply manufacturer's standard prime coat to shop-cleaned, dry surface same day as surface preparation.

F. Apply manufacturer's standard two-component, epoxy finish coats.

2.07 FUEL-OIL AST ACCESSORIES

A. Tank Manholes: 22-inch-minimum diameter; bolted, flanged, and gasketed; centered on top of tank.

B. Threaded pipe connection fittings on top of tank, for fill, supply, return, vent, sounding, and gaging. Include cast-iron plugs for shipping.

C. Striker Plates: Inside tank, on bottom below fill, vent, sounding, gage, and other tube openings.

D. Lifting Lugs: For handling and installation.

E. Ladders: Carbon-steel ladder outside tank, anchored to top and side wall. Comply with OSHA requirements.

F. Supply Tube: Extension of supply piping fitting into tank, terminating 6 inches above tank bottom and cut at a 45-degree angle.

G. Sounding and Gage Tubes: Extension of fitting into tank, terminating 6 inches above tank bottom and cut at a 45-degree angle.

2.08 SOURCE QUALITY CONTROL

A. Pressure test and inspect fuel-oil storage tanks, after fabrication and before shipment, according to ASME and the following:

1. Horizontal, Insulated, Steel ASTs: UL 142 and UL 2085.

B. Affix standards organization's code stamp.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for aboveground fuel-oil storage tanks to verify actual locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

B. Allow for cast-in-place, concrete base.

3.03 FUEL-OIL AST INSTALLATION

A. Install tank bases and supports.

B. Concrete Bases: Anchor AST to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. 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. Use 3000-psig, 28-day, compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

C. Connect piping and vent fittings.

D. Install ground connections.

E. Install tank leak-detection and monitoring devices.

F. Install steel ASTs according to STI R912.

G. Install insulated and concrete-vaulted, steel ASTs according to STI R942.

H. Fill storage tanks with fuel oil.

3.04 LABELING AND IDENTIFYING

A. Nameplates, pipe identification, and signs are specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Tanks: Minimum hydrostatic or compressed-air test pressures for fuel-oil storage tanks that have not been factory tested and do not bear the ASME code stamp or a listing mark acceptable to authorities having jurisdiction:

a. Double-Wall Tanks:

1) Inner Tanks: Minimum 3 psig and maximum 5 psig.
2) Interstitial Space: Minimum 3 psig and maximum 5 psig, or 5.3-in. Hg vacuum.

b. Where vertical height of fill and vent pipes is such that the static head imposed on the bottom of the tank is greater than 10 psig, hydrostatically test the tank and fill and vent pipes to a pressure equal to the static head thus imposed.
c. Maintain the test pressure for one hour.

B. ASTs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 24 16 - INTERNAL-COMBUSTION ENGINE EXHAUST PIPING

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Engine exhaust.
   2. Equipment drains and overflows.
   3. Unions and flanges.
   4. Pipe hangers and supports.

B. Related Sections:

   1. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
   2. Section 23 07 00 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.

1.03 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.3 - Malleable Iron Threaded Fittings.
   2. ASME B16.4 - Gray Iron Threaded Fittings.
   3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B31.1 - Power Piping.
   6. ASME B31.9 - Building Services Piping.
   7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
   1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
7. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
8. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

1.04 SYSTEM DESCRIPTION

A. Provide factory-built modular connector, manifold and stack system that is tested and listed by the Underwriters' Laboratories, Inc. to the UL 103 test standard.

B. Flexible Connectors: Use at or near engine driven equipment where piping configuration does not absorb vibration.

C. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

D. Provide pipe hangers and supports in accordance with ASME B31.1, ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

E.

F. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to floor.

G. Flexible Connectors: Use at or near engine driven equipment where piping configuration does not absorb vibration.

1.05 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate schematic layout of piping system, including equipment, critical dimensions, and sizes.

C. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer’s catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

3. Hangers and Supports: Submit manufacturers catalog information including load capacity.

D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of piping system pressure test.

F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.06 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Closeout procedures.

B. Project Record Documents: Record actual locations of valves, equipment and accessories.

C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.1 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

C. Maintain one copy of each document on site.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

C. Design piping system under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Alaska.

1.09 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 40 00 - Quality Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 ENGINE EXHAUST PIPE

A. Manufacturers: Selkirk Metalbestos IPS C4

B. Furnish double wall insulated metal stacks, tested to UL 2561, suitable for venting gases at a temperature not exceeding 1,400 deg F under continuous operating conditions.

C. Fabricate with 4 inch minimum insulated space between walls. Insulation to be ceramic fiber. Construct inner jacket of 20 gage ASTM A167 Type 316 stainless steel. Construct outer jacket of Type 316 stainless steel.

D. Clearance to Combustibles: 1/2 inch.

E. Accessories, UL labeled:

1. Ventilated Roof Thimble Assembly (MVT) consisting of ventilated thimble, ventilated tall flashing, ventilated storm collar, and associated clamp flanges.

2. Miter Cut Stack Termination (MC).

3. Drain Section (DS)

4. Adjustable Pipe Lengths (AG) for expansion and field adjustments

a. One in vertical stack

b. One horizontal stack

5. Lined Bellows Joint (BJ)
6. Horizontal drain section (DS)
7. Excessive Pressure relief valve (ER)
8. High temperature sealant rated to 2,000 degrees F.
9. Plate supports (P-PA)
10. Guy Section (GS) and three Guy Tensioners (GT)

PART 3 - EXECUTION

3.01 ENGINE EXHAUST ASSEMBLY:

A. When installed according to the manufacturer's installation instructions, the flue system and its supporting system shall resist side loads at least 1.5 times greater than the weight per foot of the piping for both horizontal and vertical portions of the system.

B. The prefabricated flue system shall be installed according to the manufacturer's installation instructions and shall conform to all applicable state and local codes.

C. Provide all modular straight sections, fittings, supports, guides, expansion joints, guy sections, guy tensioners, roof thimbles, roof flashings, storm collars and stack cap terminations as required to provide a complete system per the manufacturer's installation instructions.

D. The entire flue system from the appliance outlet to the termination point, including all accessories, except as noted, shall be from one manufacturer.

E. The vertical stack termination shall be no less than three feet above any portion of the building within ten feet of the stack penetration.

F. Roof penetrations shall be suitable for the specified roof construction and shall comply with the manufacturer's installation instructions.

3.02 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install pipe hangers and supports in accordance with Section 22 05 29.

3.03 PREPARATION

A. Remove scale and dirt on inside and outside before assembly.

B. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.04 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASTM F708, and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

G. Provide sheet lead packing between hanger or support and piping.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

I. Install pipe hangers and supports in accordance with Section 22 05 29.

3.05 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install engine exhaust piping in accordance with ASME B31.1.

3.06 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test engine exhaust piping in accordance with ASME B31.9.

END OF SECTION

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Duct Materials.
   2. Flexible ducts.
   3. Insulated flexible ducts.
   4. Ductwork fabrication.
   5. Duct cleaning.

1.03 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
   5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   8. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Air Duct Leakage Test Manual.
2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.04 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
3. Fittings.
4. Reinforcing details and spacing.
5. Seam and joint construction details.
6. Penetrations through fire rated and other walls.
7. Terminal unit, coil, and humidifier installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

C. Product Data: Submit data for duct materials.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

E. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.

1.06 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.

B. Stainless Steel Ducts: ASTM A167, Type 304.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36/A36M; steel , galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 FLEXIBLE DUCTS

A. Manufacturers: Thermaflex

B. Flexible Air Duct: UL 181, two ply vinyl film supported by helical wound spring steel wire.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
2. Maximum Velocity: 5000 fpm.
3. Temperature Range: -10 degrees F to 200 degrees F.
4. Insulation Value: R6.0
5. Surface Burning Characteristics: Max flame spread of 25, max smoke of 50.

C. Acoustical Flexible Air Duct: UL 181, CPE duct liner bonded to spring steel wire helix. Exterior jacket to have vapor barrier, fiberglass reinforced metallized film or approved equal.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
2. Maximum Velocity: 5000 fpm.
3. Temperature Range: -20 degrees F to 200 degrees F continuous.
4. Insulation: Fiberglass, minimum R6.0
5. Surface Burning Characteristics: Max flame spread of 25, max smoke of 50.

2.03 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and [as indicated on Drawings]. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and [as indicated on Drawings]. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide [airfoil] turning

vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.02 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use double nuts and lock washers on threaded rod supports.

D. Connect flexible ducts to metal ducts with draw bands.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Connect air terminal units to supply ducts directly.

3.04 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.05 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL

Supply (Heating Systems)	Galvanized Steel
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Constant Volume Supply	1 inch wg regardless of velocity.
General Exhaust	1/2 inch wg regardless of velocity.

END OF SECTION

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SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Control Dampers
   2. Back-draft dampers.
   3. Duct access doors.
   4. Flexible duct connections.

1.03 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate for shop fabricated assemblies including duct access doors.

C. Product Data: Submit data for shop fabricated assemblies and hardware used.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 CLOSE-OUT DOCUMENTS

A. Product Data: Provide as-built information of submittal requirements.

B. Maintenance: Provide operation and maintenance manuals for equipment noting model number, part numbers, and regular maintenance schedules.

1.06 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 INSULATED POSITIVE SHUT-OFF CONTROL DAMPERS

A. Manufacturer: T. A. Morrison, TAMCO 9000 or equal.

B. Extruded aluminum (6063T5) damper frame shall be not less than .080-inch in thickness. Damper frame to be 4 inches deep and shall be insulated with polystyrene on three sides if "Installed in Duct" type and on four sides if "Flanged to Duct" type.

C. Blades to be extruded aluminum (6063TS) profiles, internally insulated with non-CFC, expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.

D. Blade and frame seals shall be of extruded silicone and shall be secured in an integral slot within the aluminum extrusions.

E. Bearings to be comprised of a celcon inner bearing fixed to a 7/16-inch aluminum hexagon blade pin rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal, or metal-to-plastic contact.

F. Linkage hardware shall be installed in frame side, shall be constructed of aluminum and corrosion resistant, zinc, and nickel-plated steel, complete with cup-point trunnion screws for a slip-proof grip.

G. Dampers shall be opposed blade action. Dampers shall be made to size required without blanking off of free area. Dampers shall be available in two mounting types: i.e. "Installed in Duct" or "Flanged to Duct." Dampers to be designed for operation in temperatures ranging between minus 40 deg F and 212 deg F.

H. Air leakage through a 48- by 48-inch damper shall not exceed 4.12 cfm/sq. ft. against 4 inches w.g. differential static pressure at standard air. Standard air leakage data to be certified under the AMCA Certified Ratings Program. Air leakage shall not exceed 4.9 cfm/sq. ft. against 4 inches w.g. differential static pressure at minus 40 deg F.

I. Pressure drop of a fully open 48- by 48-inch damper shall not exceed .03-inch w.g. at 1000 fpm. Installation of dampers shall be in accordance with manufacturer's installation guidelines.

2.02 BACK-DRAFT DAMPERS

A. Manufacturers:
1. Ruskin
2. Greenheck
3. Approved substitutions in accordance with Division 1.

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage (1.5 mm) thick steel, or extruded aluminum. Blades, maximum 6 inch (150 mm) width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Reach-through doors shall be located at fire dampers, inlet side of coils, and where required to service internal duct appurtenances. Doors shall be stiffened to prevent rattle or vibration and shall be secured airtight with felt-edged gaskets. Secure the hinge and sash lock. Access doors to be insulated where adjacent duct is insulated or lined. Access doors shall be suitably sized for intended duty. See Section 3.02 Installation for sizes. Ruskin ADH or equal.

2.04 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers: Thermaflex

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Round flexible duct connections shall be of a two element spiral construction composed of a corrosion resistant metal supporting spiral and a coated fabric with a mineral base. Flexible duct connectors shall be listed by UL, Class 1 ducts, and shall have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50. Fuel contributed rating not exceeding 50.

D. Square flexible duct connections shall be UL listed, fire-retardant, neoprene coated, woven glass fiber fabric, in accordance with NFPA 90A, minimum density 30 oz/sq. ft. and crimped into 3 inch wide and 24 gauge thick galvanized steel collars. Install per SMACNA HVAC Duct Construction Standards.

E. The flexible duct connection shall be suitable for 1 1/2 times the duct pressure at the connection. Flexible separation shall not be less than 6 inches between separated metals.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installation are ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.02 INSTALLATION.

A. Install equipment in accordance with manufacturer’s installation recommendations and code.

B. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

C. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

D. Access Doors: Install access doors at the following locations as indicated on Drawings:

E. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 size for shoulder access, and as indicated on Drawings. Review locations prior to fabrication.

3.03 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements for demonstration and training.

B. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 233400 - HVAC FANS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Fans, propeller - sidewall mounted.

1.03 ACTION SUBMITTALS

A. Product Data:

   1. For each type of product.

      a. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
      b. Rated capacities, furnished specialties, and accessories for each fan.
      c. Fans:

         1) Certified fan performance curves with system operating conditions indicated.
         2) Certified fan sound-power ratings.
         3) Fan construction and accessories.
         4) Motor ratings and electrical characteristics, plus motor and electrical accessories.
         5) Fan speed controllers.

      d. Material thickness and finishes, including color charts.
      e. Dampers, including housings, linkages, and operators.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fans and ventilators, include the following:

   1. Operation in normal and emergency modes.
   2. Operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 SIDEWALL PROPELLER EXHAUST FAN, EF-1

A. Manufacturers: Greenheck.

B. Construction:
1. Impeller: Fabricated steel or cast aluminum propellor with hubs, statically and dynamically balanced, keyed and locked to shaft, directly connected to motor.
2. Frame: One piece, galvanized steel drive frame, mounting flanges and supports.
3. Direct driven motor in the airstream.
4. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor, and wall mounted multiple speed switch.

C. Accessories:
1. Back-draft Damper: Multiple blade with offset hinge pin, blades linked.
2. Insulated Control Damper: Multiple blade with offset hinge pin, blades linked, line voltage motor drive, power open, spring return.
3. Safety Screens: Expanded galvanized metal over inlet, motor, and drive; to comply with OSHA regulations.
4. Hood: Weather shield, to exclude rain and snow.

D. Motors
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
2. 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.
3. Provide controls power supply and transformer as necessary for fully functioning system.

2.02 BELT DRIVE SIDEWALL PROPELLER FAN, VF-1

A. Manufacturers: Greenheck, Loren Cook.

B. Source Limitations: Obtain sidewall-mounted propeller fans from single manufacturer.

C. Construction:
1. Impeller: Fabricated steel or cast aluminum propellor with hubs, statically and dynamically balanced, keyed and locked to shaft, directly connected to motor.
2. Frame: One piece, galvanized steel drive frame, mounting flanges and supports.
3. Direct driven motor in the airstream.
4. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor, and wall mounted multiple speed switch.

D. Accessories:
1. Insulated Control Damper: Multiple blade with offset hinge pin, blades linked, line voltage motor drive, power open, spring return.
2. Safety Screens: Expanded galvanized metal over inlet, motor, and drive; to comply with OSHA regulations.
3. Hood: Weather shield, to exclude rain and snow.

E. Motors
   1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
   2. 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.

F. Provide controls power supply and transformer as necessary for fully functioning system

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, in accordance with manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:
   1. Unit Support: Install fans level on structural curbs. **Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.**

E. Install units with adequate clearances for service and maintenance.

F. Label fans in accordance with requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

   1. Nameplate is to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
   2. Nameplate is to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.03 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Lubricate bearings.

3.05 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties.
3. Fans and components will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

3.07 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain HVAC fans.

END OF SECTION

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Louvers.
   2. Hoods.

1.03 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Color and finish chart as noted in Products section.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 2 - PRODUCTS

2.01 LOUVERS

A. Manufacturers: Ruskin

B. Product Description: Stationary, Drainable.

C. Type: 6 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame.

D. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory baked enamel finish color to be selected.

E. Mounting: Furnish with exterior angle flange for installation.

F. Bird Screen: Bird screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

G. Insect Screen: Removable steel mesh, set in steel frame.

2.02 WEATHER HOODS

A. Fabricate weather hoods in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible.

B. Fabricate of reinforced galvanized steel, minimum 18 gauge. Furnish bird screen with 1-inch square mesh. Paint hood to match exterior.

C. Seal exterior wall penetration weather tight.

D. Bird Screen: Bird screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

E. Insect Screen: Removable steel mesh, set in steel frame.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify inlet and outlet locations.

C. Verify wall systems are ready for installation.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer’s instructions.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

SECTION 238239.19 - ELECTRIC HEATERS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.02 SUMMARY

A. Section Includes:
   1. Unit heaters with propeller fans and electric-resistance heating coils.
   2. Radiant ceiling panels with electric-resistance heating coils.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

   1. Include plans, elevations, sections, and details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include details of anchorages and attachments to structure and to supported equipment.
   4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
   5. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 HORIZONTAL UNIT HEATERS (UH-1, UH-2)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chromalox, Inc.
2. Modine.

B. Heaters: Assembly including chassis, electric finned heating coil, fan, motor, and controls. Comply with UL 2021.

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. Cabinet
1. Front Panel: Stamped-steel with individual, adjustable louvers and with removable panels fastened with tamperproof fasteners.
2. Finish: All metal surfaces of the casing shall be phosphate coated to resist corrosion, and finished in almond powder coated paint.
3. Airstream Surfaces: Surfaces in contact with the airstream comply with requirements in ASHRAE 62.1.
4. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

E. Coil
1. Electric-Resistance Heating Coil: The electric heating bank shall be of metal sheath heating elements with furnace brazed fins for improved heat transfer. Automatic reset thermal overheat protection shall be wired for instantaneous de-energizing of built-in control of contactor holding coil in case of thermal overload. All units shall include a heater contactor.

F. Fan and Motor
1. Fan: Aluminum propeller directly connected to motor.
2. Motor: Permanently lubricated. .Motors shall be of the totally enclosed continuous fan-duty sleeve bearing type equipped with built-in thermal overload protection. Each unit shall be equipped with a combination fan guard/motor support resiliently mounted at four points to absorb any motor vibration.
3. Comply with requirements in Section 230500 "Common Work Results for HVAC."

G. Controls
1. Controls: Unit-mounted thermostat.
2. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

H. Supports
1. Provide manufacturer’s support system.

2.02 CONVECTION HEATERS (CH-1)

A. Manufacturers:

1. Chromalox, Inc.
2. Modine.

B. Heaters: Assembly including chassis, electric finned heating coil, and controls. Comply with UL 2021.

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. Cabinet
1. Enclosure: Enclosure shall be constructed of reinforced 18 gauge steel. Grilles shall be closely space to restrict entry of foreign objects.
2. Finish: All metal surfaces of the casing shall be chemically coated to resist corrosion, and finished in almond powder coated paint.
3. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

E. Coil
1. Electric-Resistance Heating Coil: The electric heating bank shall be of metal sheath heating elements with furnace brazed fins for improved heat transfer. Automatic reset thermal overheat protection shall be wired for instantaneous de-energizing of built-in control of contactor holding coil in case of thermal overload. All units shall include a heater contactor.

F. Controls
1. Heater shall include an adjustable thermostat.

G. Supports
1. Provide manufacturer’s support system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive electric unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF ELECTRIC UNIT HEATERS

A. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

B. Provide support as required and in accordance with manufacturer’s recommendations.

C. Install electric unit heaters to comply with NFPA 90A.

D. Install electric unit heaters level and plumb.

E. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

F. Protection: Install finished cabinet units with protective covers during remainder of construction.

G. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

H. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
2. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Connectors and splices.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2. Comply with UL 83.
2. Type XHHW-2. Comply with UL 44.
3. CONNECTORS AND SPLICES

E. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

F. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

G. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Mechanical.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; stranded.

B. Branch Circuits:

1. Copper: stranded.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Branch circuits: Type THHN/THWN-2 or XHHW-2, single conductors in raceway.

F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

G. Outdoor and wet locations and indoors with ambient temperature below 32 deg F:

1. Branch circuits: Type XHHW-2, single conductors in raceway.
2. Cord Drops and Portable Appliance Connections: Indoor/outdoor; EPDM conductor insulation; CPE jacket; solid rubber non-wicking filler; weather, water, and oil resistant; continuously submersible in water; 105 to minus 50 deg C; 600V Type SOOW-A and 300V Type SJOOW-A hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 INSTALLATION, GENERAL

A. Complete raceway installation between conductor and cable termination points in accordance with Section 260533.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.

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.

3.04 CONNECTIONS

A. 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-486B.

B. Make splices, terminations, and taps that are compatible with conductor material.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping.

3.08 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements:

    a. Programmable Logic Controller Panel PLC-01.
    b. Booster Pump BP-01.
    c. Booster Pump BP-02.
    d. Booster Pump BP-03.
    e. Recirculating Pump RC-01.

3. Perform each of the following visual and electrical tests:

    a. Inspect the exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.

f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

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SECTION 260522 - HEAT TRACE CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes plumbing piping heat tracing for freeze prevention with the following electric heating cables:

1. Self-regulating, parallel resistance.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.07 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace electric heating cables that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Chromalox, Inc.
2. Nelson Heat Trace.
3. Raychem; Tyco Thermal Controls.
4. Thermon Americas Inc.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 16 or 18 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, non-heating leads with connectors at one end and seal the opposite end watertight. Cables shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: Tinned-copper braid and polyolefin outer jacket with ultraviolet inhibitor.

F. Maximum Operating Temperature (Power On): 150 deg F.

G. Maximum Exposure Temperature (Power Off): 80 deg F.

H. 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.

I. Capacities and Characteristics:

1. Maximum Heat Output: 8 W/ft.
2. Electrical Characteristics for Single-Circuit Connection:

a. Volts: 120.
b. Phase: Single-phase.
c. Hertz: 60.

2.02 ACCESSORIES

A. Cable Installation Accessories: Power connection and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Lighted End of Circuit Terminations: NEMA 4X, IP66 rated nonmetallic enclosure with red LED pilot light.

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Pipe Freeze Protection: Self-regulating, parallel-resistance heating cable.

3.03 INSTALLATION

A. Install electric heating cable according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Install electric heating cable as indicated on Drawings.

C. Electric Heating-Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.
3. Install warning tape on piping insulation where piping is equipped with electric heating cables.

3.04 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power and Control Conductors and Cables."

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 PROTECTION

A. Protect installed heating cables, including non-heating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Category 6 balanced twisted pair cable.
2. Balanced twisted pair cable hardware.
3. Control cable.
4. Control-circuit conductors.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Category 6 balanced twisted pair cable.
2. Balanced twisted pair cable hardware.
3. Control cable.
4. Control-circuit conductors.

1.04 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 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. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.02 CATEGORY 6 BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.

B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100 ohm, No. 23 AWG solid copper.

D. Shielding/Screening: Shielded twisted pairs (FTP).

E. Jacket: Blue thermoplastic.

2.03 BALANCED TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.

B. General Requirements for Balanced Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables must be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain balanced twisted pair cable hardware from single source from single manufacturer.

D. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.

E. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.04 CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Shielded pairs.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.05 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type XHHW-2, complying with UL 44 in raceway.

B. Class 2 Control Circuits: Stranded copper, Type XHHW-2, complying with UL 44 in raceway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type XHHW-2, complying with UL 44 in raceway.

2.06 SOURCE QUALITY CONTROL

A. Factory test twisted pair cables according to TIA-568-C.2.

B. Cable will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Test cables on receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

3.02 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems" for raceway selection and installation requirements for conduits as supplemented or modified in this Section.

B. Comply with requirements in Section 260533.16 "Boxes and Covers for Electrical Systems" for raceway selection and installation requirements for boxes as supplemented or modified in this Section.

1. Outlet boxes for cables must be no smaller than 4 inch square by 1-1/2 inch deep

2. Flexible metal conduit must not be used.

C. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

D. Install manufactured conduit sweeps and long-radius elbows if possible.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
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 ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. 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. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 271513 "Communications Copper Horizontal Cabling" unless otherwise indicated.
3. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications 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 must be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inch.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inch.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inch.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment must be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inch.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inch.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inch.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures must be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inch.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inch.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inch.

3.04 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 14 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.05 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.06 GROUNDING

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.07 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.

C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.08 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.

    a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding bushings.
4. Grounding and bonding hubs.
5. Grounding and bonding connectors.
6. Grounding and bonding busbars.
7. Grounding (earthing) electrodes.

B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" specifies additional requirements for grounding and bonding of communications raceways, boxes, and cable trays.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Include the following:

a. Plans showing locations of grounding features described in "Field Quality Control for Grounding and Bonding of Electrical Power" Article, including the following:

1) Grounding electrodes.

2) Grounding arrangements and connections for separately derived systems.

PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, THWN-2 or XHHW-2, copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. ASTM - Bare Copper Grounding and Bonding Conductor:

1. Referenced Standards: Complying with one or more of the following:

a. Soft or Annealed Copper Wire: ASTM B3.
b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.02 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

D. UL KDER and KDSH - Hex-Fitting-Type Pipe and Rod Grounding and Bonding Clamp :

1. General Characteristics:

a. Two pieces with stainless steel bolts.
b. Clamp Material: Silicon bronze.

c. Listed for outdoor use.

E. UL KDER and KDSH - U-Bolt-Type Pipe and Rod Grounding and Bonding Clamp:

1. General Characteristics:

a. Clamp Material: Brass.
b. Listed for outdoor use.

F. UL KDER - Beam Grounding and Bonding Clamp :

1. General Characteristics: Mechanical-type, terminal, ground wire access from four directions; with dual, tin-plated or silicon bronze bolts.

2.03 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. Source Limitations: Obtain products from a single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

D. UL KDER - Bonding Bushing :

1. General Characteristics: Threaded bushing with insulated throat.

E. UL KDER - Grounding Bushing :

1. General Characteristics: Threaded bushing with insulated throat and mechanical-type wire terminal.

2.04 GROUNDING AND BONDING HUBS

A. Description: Hubs with certified grounding or bonding locknut.

B. Source Limitations: Obtain products from a single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

D. UL KDER - Grounding and Bonding Hub :

1. General Characteristics: Insulated, gasketed, watertight hub with mechanical-type wire terminal.

2.05 GROUNDING AND BONDING CONNECTORS

A. Source Limitations: Obtain products from a single manufacturer.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

C. UL KDER - Pressure-Type Grounding and Bonding Busbar Cable Connector:

1. General Characteristics: Copper or copper alloy, for compression bonding of one or more conductors directly to copper busbar. Listed for direct burial.

D. UL KDER - Lay-In Lug Mechanical-Type Grounding and Bonding Busbar Terminal

1. General Characteristics: Mechanical type, aluminum terminal with set screw.

E. UL KDER - Crimped Lug Pressure-Type Grounding and Bonding Busbar Terminal:

1. General Characteristics: Cast silicon bronze, solderless compression-type wire terminals; with long barrel and two holes spaced on 5/8 or 1 inch centers for two-bolt connection to busbar.

F. UL KDER - Split-Bolt Service-Post Pressure-Type Grounding and Bonding Busbar Terminal :

1. General Characteristics: Bolts that surround cable and bond to cable under compression when nut is tightened after assembly is screwed into busbar opening.

G. UL KDER - Crimped Pressure-Type Grounding and Bonding Cable Connector:

1. General Characteristics: Crimp-and-compress connectors that bond to conductor when connector is compressed around conductor.

a. Copper alloy, C and H shaped.

H. UL KDER - Split-Bolt Pressure-Type Grounding and Bonding Cable Connector:

1. General Characteristics: Bolts that surround cable and bond to cable under compression when nut is tightened.

a. Copper alloy.

2.06 GROUNDING (EARTHING) ELECTRODES

A. Source Limitations: Obtain products from a single manufacturer.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

C. UL KDER - Rod Electrode :

1. General Characteristics: Copper-clad; 5/8 inch by 8 ft.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the facility’s grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of electrical service equipment connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.02 SELECTION OF GROUNDING AND BONDING PRODUCTS

A. Grounding and Bonding Conductors:

1. Provide solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
7. Underground Grounding Conductors: Install bare tinned-copper conductor, 2/0 AWG minimum.

B. Grounding and Bonding Connectors:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Crimped pressure connectors.
3. Connections to Structural Steel: Welded connectors.

C. Grounding and Bonding Busbars: Provide in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated on Drawings.

3.03 SELECTION OF GROUNDING AND BONDING PRODUCTS FOR COMMUNICATIONS

A. Comply with Section 270528 "Pathways for Communications Systems".

3.04 INSTALLATION OF GROUNDING AND BONDING

A. Comply with manufacturer's published instructions.

B. Reference Standards:

C. Special Techniques:

1. Grounding and Bonding Conductors:

a. Route along the 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. Underground Grounding Conductors:

1) Bury at least 30 inch below grade.

2. Grounding and Bonding Connectors: Make connections so the possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
f. 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 adjacent parts.
2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3) Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use bolted clamp.

g. Grounding and Bonding for Piping:

1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2) Water Meter and Sensor Device Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.

h. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install

tinned bonding jumper to bond across flexible duct connections to achieve continuity.

i. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft apart.

3. Electrodes:

a. Ground Rods: Drive rods until tops are 2 inch below finished floor or final grade unless otherwise indicated.

1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2) Use exothermic welds for below-grade connections.

b. For the grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.

c. Concrete-Encased Electrode (Ufer Ground):

1) Fabricate in accordance with NFPA 70; use minimum of 20 ft of bare copper conductor not smaller than 4 AWG.

a) If concrete foundation is less than 20 ft long, coil excess conductor within base of foundation.
b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

2) Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.

4. Grounding at Service:

a. Equipment grounding conductors and grounding electrode conductors must be connected to ground busbar. Install main bonding jumper between neutral and ground buses.

5. Equipment Grounding and Bonding:

a. Install insulated equipment grounding conductors with 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 separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
d. Poles Supporting Outdoor Lighting Fixtures: Bond insulated equipment grounding conductor to equipment grounding terminal inside pole base.
e. Metallic Fences: Comply with requirements of IEEE C2.

1) Grounding Conductor: Bare, tinned copper, not less than 8 AWG .
2) Gates: Must be bonded to the grounding conductor with flexible bonding jumper.
3) Barbed Wire: Strands must be bonded to the grounding conductor.

6. Fence Grounding:

a. Grounding Method: At each grounding location, drive grounding rod vertically until top is 6 inch below finished grade. Connect rod to fence with 6 AWG conductor. Connect conductor to each fence component at grounding location.
b. Fences within 100 ft of Buildings, Structures, Walkways, and Roadways: Ground fence at maximum intervals of 750 ft.

1) Gates and Other Fence Openings: Ground fence on each side of opening.

a) Bond metal gates to gate posts by connecting bonding jumpers between gate post and gate frame.
b) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use 2 AWG wire and bury it at least 18 inch below finished grade.

3.05 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

A. Acceptance Testing Preparation:

B. Field tests and inspections must be witnessed by Engineer .

C. Tests and Inspections:

1. After installing the grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at the group of ground rods and Ufer ground. Make tests at ground rods before conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural

drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.

c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Nonconforming Work:

1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

E. Collect, assemble, and submit test and inspection reports.

1. Report measured ground resistances that exceed the following values:

a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω .

3.06 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.
2. Fabricated metal equipment support assemblies.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Galvanized steel.
3. Channel Width: Selected for applicable load criteria.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Conduit Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

D. 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.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 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 Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 SELECTION

A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA NEIS 101

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways specified in Section 260533.13 "Conduits for Electrical Systems."

D. Comply with requirements for boxes specified in Section 260533.16 "Boxes and Covers for Electrical Systems."

E. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by NFPA 70. Minimum rod size must be 1/4 inch in diameter.

F. 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.

3.02 INSTALLATION OF SUPPORTS

A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.

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 must be the weight of supported components plus 200 lb.

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 by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch thick.

4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated 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. Submit welding certificates.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inch larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 4000 psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup:

1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

    a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

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SECTION 260533.13 - CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type EMT-S duct raceways and elbows.
2. Type ERMC-S duct raceways, elbows, couplings, and nipples.
3. Type FMC-S duct raceways.
4. Type IMC duct raceways.
5. Type LFMC duct raceways.
6. Type PVC duct raceways and fittings.
7. Type RTRC-BG duct raceways and fittings.
8. Fittings for conduit, tubing, and cable.
9. Electrically conductive corrosion-resistant compounds for threaded conduit.
10. Solvent cements.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for underground utility construction.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 DEFINITIONS

A. Conduit: A structure containing one or more duct raceways.

B. Duct Raceway: A single enclosed raceway for conductors or cable.

C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.04 ACTION SUBMITTALS

A. Product Data:

1. Type EMT-S duct raceways and elbows.

2. Type ERMC-S duct raceways, elbows, couplings, and nipples.
3. Type FMC-S duct raceways.
4. Type IMC duct raceways.
5. Type LFMC duct raceways.
6. Type PVC duct raceways and fittings. Type RTRC-BG duct raceways and fittings.
7. Fittings for conduit, tubing, and cable.
8. Electrically conductive corrosion-resistant compounds for threaded conduit.
9. Solvent cements.

PART 2 - PRODUCTS

2.01 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Material: Steel.
2. Options:

a. Interior Coating: Zinc with organic top coating .
b. Minimum Trade Size: Metric designator 16 (trade size 1/2) .

2.02 TYPE ERMC-S DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DYIX; including UL 6.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL DYIX - Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:

1. Exterior Coating: Zinc.
2. Options:

a. Interior Coating: Zinc with organic top coating.
b. Minimum Trade Size: Metric designator 16 (trade size 1/2).

2.03 TYPE FMC-S DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DXUZ; including UL 1.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL DXUZ - Steel Flexible Metal Conduit (FMC-S):

1. Material: Steel.
2. Options:

a. Minimum Trade Size: Metric designator 16 (trade size 1/2).

2.04 TYPE IMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DYBY; including UL 1242.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL DYBY - Steel Intermediate Metal Conduit (IMC):

1. Options:

a. Exterior Coating: Zinc.
b. Interior Coating: Zinc with organic top coating.

c. Minimum Trade Size: Metric designator 16 (trade size 1/2).

2.05 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):

1. Material: Steel.
2. Options:

a. Minimum Trade Size: Metric designator 16 (trade size 1/2).

2.06 TYPE RTRC-BG DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DZKT; including UL 2420.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DZKT - Low-Halogen, Belowground Reinforced Thermosetting Resin Conduit (RTRC-BG) and Fittings:

1. Additional Characteristics: Type BG.
2. Options:

a. Minimum Trade Size: Metric designator 16 (trade size 1/2**)**.

2.07 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL DWTT - Fittings for Type ERMC, Type IMC, Raceways:

1. Listing Criteria: UL CCN DWTT; including UL 514B.
2. Options:

    a. Material: Steel.
    b. Coupling Method: Use threaded rigid steel steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10..

D. UL FKAV - Fittings for Type EMT Duct Raceways:

1. Listing Criteria: UL CCN FKAV; including UL 514B.
2. Options:

    a. Material: Steel.
    b. Coupling Method: Setscrew coupling..

E. UL ILNR - Fittings for Type FMC Duct Raceways:

1. Listing Criteria: UL CCN ILNR; including UL 514B.

F. UL DXAS - Fittings for Type LFMC Duct Raceways:

1. Listing Criteria: UL CCN DXAS; including UL 514B.

2.08 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN FOIZ; including UL Subject 2419.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL FOIZ - Electrically Conductive Corrosion-Resistant Compound for Threaded Conduit:

2.09 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DWTT; including UL 514B.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DWTT - Solvent Cements for Type PVC Duct Raceways and Fittings.

PART 3 - EXECUTION

3.01 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Engineer for resolution of conflicting requirements.

B. Outdoors:

1. Exposed and Subject to Severe Physical Damage: ERMC.
2. Exposed and Subject to Physical Damage: ERMC.

a. Locations less than 2.5 m (8 ft) above the finished floor.

3. Exposed and Not Subject to Physical Damage: ERMC and RTRC.
4. Concealed Aboveground: ERMC.
5. Direct Buried: ERMC, RTRC, and PVC-80 .
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Exposed and Subject to Physical Damage: ERMC or IMC.
2. Exposed and Not Subject to Physical Damage: ERMC, IMC, EMT .
3. Damp or Wet Locations: ERMC, RTRC, or IMC, and LFMC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC and FMC .

D. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.02 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
2. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
3. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
4. Type IMC: Article 342 of NFPA 70 and NECA NEIS 101.
5. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
6. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
7. Type RTRC: Article 355 of NFPA 70 and NECA NEIS 111.
8. Consult Engineer for resolution of conflicting requirements.

C. Special Installation Techniques:

1. General Requirements for Installation of Duct Raceways:

a. Complete duct raceway installation before starting conductor installation.
b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug the coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
c. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
d. Make bends in duct raceways using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
e. Install conduits parallel or perpendicular to building lines.
f. Support conduit within 12 inch of enclosures to which attached.
g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound.

h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:

1) Where conduits pass from warm to cold locations,.
2) Where an underground service duct raceway enters a building or structure.
3) Conduit extending from interior to exterior of building.
4) Where otherwise required by NFPA 70.

i. Do not install conduits within 2 inch of the bottom side of a metal deck roof.

j. Keep duct raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.

k. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.

l. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.

m. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.

1) Termination fittings with shoulders do not require two locknuts.

n. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

2. Types ERMC and IMC:

a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.

b. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.

3. Types FMC and LFMC:

a. Provide a maximum of 36 inch of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

4. Duct Raceways Embedded in Slabs:

a. Run duct raceways larger than metric designator 27 (trade size 1) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place

duct raceway close to slab support. Secure duct raceways to reinforcement at maximum 10 ft intervals.

b. Arrange duct raceways to cross building expansion joints with expansion fittings at right angles to the joint.

c. Arrange duct raceways to ensure that each is surrounded by minimum of 2 inch of concrete without voids.

d. Do not embed threadless fittings in concrete unless locations have been specifically approved by Engineer.

5. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:

a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG. Install insulated throat metal grounding bushings on service conduits.

6. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

D. Interfaces with Other Work:

1. Coordinate with Section 078413 "Penetration Firestopping" for installation of firestopping at penetrations of fire-rated floor and wall assemblies.

2. Coordinate with Section 260529 "Hangers and Supports for Electrical Systems" for installation of conduit hangers and supports.

3.03 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION

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SECTION 260533.16 - BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.
3. Cover plates for device boxes.
4. Hoods for outlet boxes.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.
3. Cover plates for device boxes.
4. Hoods for outlet boxes.

PART 2 - PRODUCTS

2.01 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN QCIT; including UL 514A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL QCIT - Metallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Options:

a. Material: Sheet steel Cast metal.
b. Sheet Metal Depth: Minimum 2 inch.
c. Cast-Metal Depth: Minimum 1.8 inch.
d. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb and marked with maximum allowable weight.

D. UL QCIT - Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

E. UL QCIT - Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Options:

a. Material: Sheet steel or Cast metal.
b. Sheet Metal Depth: minimum 2 inch.
c. Cast-Metal Depth: minimum 1.8 inch.

2.02 JUNCTION BOXES AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN BGUZ; including UL 50 and UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

    a. Options: Degree of Protection: Type 1.

D. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

    a. Options: Degree of Protection: Type 3SX and Type 4X.

E. UL BGUZ - Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

    a. Options: Degree of Protection: Type 4.

2.03 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCIT or UL CCN QCMZ; including UL 514D.
3. Wallplate-Securing Screws: Metal with head color to match wallplate finish.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

C. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:

1. Options:

    a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
    b. Wallplate Material: Galvanized steel.

2.04 HOODS FOR OUTLET BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria:

    a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.

b. Receptacle, Hood, Cover Plate, Gaskets, and Seals: UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.

3. Mounts to box using fasteners different from wiring device.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Extra-Duty, While-in-Use Hoods for Outlet Boxes:

1. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
2. Options:

a. Provides gray, weatherproof, "while-in-use" cover.
b. Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.01 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:

a. Type 3SX or 4X unless otherwise indicated.

2. Indoors:

a. Type 1 unless otherwise indicated.
b. Damp or Dusty Locations: Type 12.
c. Locations Exposed to Corrosive Agents: Type 4X.

3.02 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
2. Consult Owner for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
2. Mount boxes at heights indicated on Drawings. Install boxes with height measured to center of box unless otherwise indicated.
3. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
4. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

5. Identification: Provide labels for boxes and associated electrical equipment.

   a. Identify field-installed conductors, interconnecting wiring, and components.
   b. Provide warning signs.
   c. Label each box with engraved metal or laminated-plastic nameplate.

3.03 CLEANING

A. Remove construction dust and debris from boxes before installing wallplates, covers, and hoods.

3.04 PROTECTION

A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

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SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type ERMC-S raceways, elbows, couplings, and nipples.
2. Type PVC raceways and fittings.
3. Type RTRC-BG raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Electrically conductive corrosion-resistant compounds for threaded conduit.
6. Solvent cements.
7. Handholes and boxes for exterior underground wiring.

B. Related Requirements:

1. Section 260533.13 "Conduits for Electrical Systems" specifies conduit inside and outside the building, and mounted to structures above grade.
2. Section 260553 "Identification for Electrical Systems" specifies underground-line warning tape and concrete cable routing markers (warning planks).

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 DEFINITIONS

A. Duct: A single raceway or multiple raceways installed singly or as components of a duct bank.

B. Duct Bank: Two or more ducts installed in parallel, direct buried or with additional casing materials such as concrete.

C. Handhole: An underground chamber containing electrical cables, sized such that personnel are not required to enter in order to access the cables.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For concrete and steel used in precast concrete handholes, also include product certificates as required by ASTM C858.

PART 2 - PRODUCTS

2.01 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 6 and UL CCN DYIX.

B. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:

1. Exterior Coating: Zinc.
2. Options:

a. Interior Coating: Zinc with organic top coating.
b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.02 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651 and UL CCN DZYR.

B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Dimensional Specifications: Schedule 40.
2. Options:

a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Dimensional Specifications: Schedule 80.
2. Options:

a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.03 TYPE RTRC-BG RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 2420 and UL CCN DZKT, for Type BG.

B. Low-Halogen, Belowground Reinforced Thermosetting Resin Conduit (RTRC-BG) and Fittings:

1. Options:

a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.04 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Metallic Fittings for Type ERMC, Type PVC, and Type RTRC Raceways:

1. General Characteristics: UL 514B and UL CCN DWTT.
2. Options:

a. Material: Steel.
b. Coupling Method: Raintight compression coupling with distinctive color gland nut.
c. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.05 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL Subject 2419 and UL CCN FOIZ.

2.06 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.

2.07 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:

    a. ASTM C858 for design and manufacturing processes.
    b. SCTE 77.

B. Precast Concrete Handholes and Boxes :

1. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover must form top of enclosure and must have load rating consistent with that of handhole or box.
2. Configuration: Units must be designed for flush burial and have open bottom unless otherwise indicated.
3. Frame and Cover:

    a. Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
    b. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
    c. Cover Legend: Molded lettering, "ELECTRIC" ,

4. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension must provide increased depth of 12 inch .
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

5. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.

6. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

    a. Type and size: Match fittings to duct to be terminated.
    b. Fittings must align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.

2.08 DUCT SEALING

A. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Compound must be capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.

B. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

2.09 SOURCE QUALITY CONTROL

A. Factory Tests for Handholes and Boxes:

1. Factory Tests and Inspections: Perform the following tests and inspections on handholes and boxes, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, before delivering to site. Affix label with name and date of manufacturer's certification of system compliance.

a. Precast Concrete Utility Structures: Test and inspect in accordance with ASTM C1037.

2. Nonconforming Work:

a. Equipment that does not pass tests and inspections will be considered defective.

3. Factory Test Reports: Prepare and submit factory test and inspection reports.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate layout and installation of duct, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Engineer if there is conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct entrances into handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct will drain to handholes, and as approved by Engineer.

3.02 SELECTION OF UNDERGROUND DUCTS

A. Duct for Electrical Feeders 600 V and Less: PVC-80 or RTRC-BG, direct buried unless otherwise indicated.

B. Duct for Electrical Branch Circuits: PVC-80 or RTRC-BG, direct buried unless otherwise indicated.

C. Stub-ups: Concrete encased, ERMC-S.

3.03 SELECTION OF UNDERGROUND ENCLOSURES

A. Handholes and Boxes:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-10 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
3. Units in Sidewalk and Similar Applications with Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
4. Cover design load must not exceed load rating of handhole or box.

3.04 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Restore area after construction vehicle traffic in immediate area is complete.

C. Restore surface features at areas disturbed by excavation and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

3.05 INSTALLATION OF DUCTS

A. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Steel raceway, bends, and fittings in single duct run must be of same type.
2. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
3. Curves and Bends:

    a. Field bending must be in accordance with NFPA 70 minimum radii requirements. Use PVC heating bender for bending PVC conduit.
    b. Duct must have maximum of 180 degrees of bends between pull points.

4. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.

a. Install insulated grounding bushings on steel raceway terminations that are less than 12 inch below grade or floor level and do not terminate in hubs.

5. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed.
6. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated.
7. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig hydrostatic pressure.
8. Pulling Cord: Install 200 lbf test nylon cord in empty ducts.

a. Stub-ups to Outdoor Equipment: Extend steel raceway horizontally minimum of 60 inch from edge of equipment base.

1) Stub-ups must be minimum 6 inch above finished grade or concrete pad and minimum 3 inch from conduit side to edge of slab.

b. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of wall. Install insulated grounding bushings on terminations at equipment.

1) Stub-ups must be minimum 4 inch above finished floor and no less than 3 inch from conduit side to edge of slab.

9. Direct-Buried Duct and Duct Bank:

a. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inch in nominal diameter.
b. Width: Excavate trench 3 inch wider than duct on each side.
c. Depth: Install top of duct at least 24 inch below finished grade unless otherwise indicated.
d. Place minimum 3 inch of sand as bed for duct. Place sand to minimum of 6 inch above top level of duct.
e. Install duct with minimum of 3 inch between ducts for like services and 6 inch between power and communications duct.
f. Install manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct.

1) Couple RNC duct to steel raceway with adapters designed for this purpose,
2) Stub-ups through interior floors must be minimum 4 inch above finished floor and no less than 3 inch from conduit side to edge of equipment pad or floor slab.

g. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to

4 inch over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

10. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inch above duct .
11. Ground ducts and duct banks in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.06 INSTALLATION OF CONCRETE HANDHOLES AND BOXES

A. Reference Standards:

1. Precast Concrete Handholes: Comply with ASTM C891 unless otherwise indicated.
2. Consult Engineer for resolution of conflicting requirements.

B. Special Techniques:

1. Precast Concrete Handholes:

a. Install units level and plumb and with orientation and depth coordinated with connecting duct to minimize bends and deflections required for proper entrances.
b. Unless otherwise indicated, support units on level bed of crushed stone or gravel graded from 1 inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
c. Field-cut openings for conduits in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

2. Elevations:

a. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
b. Where indicated, cast handhole cover frame integrally with handhole structure.

3. Ground handholes and boxes in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.

B. Nonconforming Work:

1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
2. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.08 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION

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SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 - PRODUCTS

2.01 ROUND SLEEVES

A. Steel Wall Sleeves:

1. General Characteristics: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. PVC Pipe Sleeves:

1. General Characteristics: ASTM D1785, Schedule 40.

C. Round, Galvanized-Steel, Sheet Metal Sleeves:

1. General Characteristics: Galvanized-steel sheet; thickness not less than 0.0239 inch; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.02 SLEEVE-SEAL FITTINGS

A. General Characteristics: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in wall. Unit must have plastic or rubber waterstop collar with center opening to match piping OD.

2.03 FOAM SEALANTS

A. Performance Criteria:

1. General Characteristics: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.01 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Labels.
2. Tapes.
3. Tags.
4. Signs.
5. Cable ties.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.01 LABELS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

B. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

C. UL PGDQ2 - Self-Adhesive Wraparound Labels: Preprinted, 3 mil thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather-, and chemical-resistant; self-laminating, with protective shield over legend. Size labels such that clear shield overlaps entire printed legend.
2. Marker for Labels:
   a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. UL PGDQ2 - Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

2.02 TAPES

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil thick by 1 to 2 inch wide; compounded for outdoor use.

C. Tape: 4 inch wide black stripes on 10 inch centers placed diagonally over orange background and are 12 inch wide. Stop stripes at legends.

D. Floor Marking Tape: 2 inch wide, 5 mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

E. Underground-Line Warning Tape:

1. Tape:

   a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical and communications utility lines.
   b. Printing on tape must be permanent and may not be damaged by burial operations.
   c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

   a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
   b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".
   c. Inscriptions for Orange Tapes: "CAUTION BURIED FIBER OPTIC LINE BELOW".

3. Detectable Line-Warning Tape:

   a. Detectable three-layer laminate, consisting of printed pigmented polyolefin film, solid aluminum-foil core, and clear protective film that allows inspection of

conductive core; bright colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
b. Width: 3 inch.
c. Overall Thickness: 5 mil.
d. Foil Core Thickness: 0.35 mil.
e. Weight: 28 lb/1000 sq. ft.
f. Tensile in accordance with ASTM D882: 70 lbf and 4600 psi.

2.03 TAGS

A. Write-on Tags:

1. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags:
   a. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.04 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4 inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inch.

B. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

   a. For signs up to 20 sq. inch, minimum 1/16 inch thick.
   b. For signs larger than 20 sq. inch, 1/8 inch thick.
   c. Engraved legend with white letters on dark gray background.
   d. Punched or drilled for mechanical fasteners with 1/4 inch grommets in corners for mounting.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.05 CABLE TIES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.

B. UL ZODZ - UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

PART 3 - EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by the manufacturer of the identification products.

3.02 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

A. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color must be factory applied.
2. Colors for 208Y/120 V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480Y/277 V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

4. Color for Neutral (Grounded Conductor): White or gray.
5. Color for Equipment Ground: Green.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Locations of Underground Lines: Underground-line warning tape for power and lighting.

D. Handholes, and Pull and Junction Boxes, 1000 V or Less: For conductors in pull and junction boxes, and handholes, use vinyl wraparound labels self-adhesive wraparound labels self-adhesive vinyl tape to identify phase.

1. Identify system voltage .

E. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:

1. Panelboard designation.
2. Colon or dash.
3. Branch circuit number.

F. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated.

G. Equipment Identification Labels:

1. White letters on dark field.
2. Indoor Equipment: Self-adhesive label.
3. Outdoor Equipment: Laminated acrylic or melamine sign.
4. Equipment to Be Labeled:

a. Enclosures: Identify front of each with self-adhesive labels containing equipment designation.
b. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved laminated acrylic or melamine label.
c. Enclosures and electrical cabinets.
d. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
e. Enclosed switches.
f. Enclosed circuit breakers.
g. Enclosed controllers.
h. Variable-speed controllers.
i. Push-button stations.
j. Power-transfer equipment.
k. Contactors.
l. Remote-controlled switches and control devices.
m. Power-generating units.
n. Monitoring and control equipment.

H. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.

3.03 SELECTION OF SIGNS AND HAZARD MARKINGS

A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.

B. Signs, labels, and tags required for personnel safety must comply with the following standards:

1. Safety Colors: NEMA Z535.1.
2. Facility Safety Signs: NEMA Z535.2.
3. Safety Symbols: NEMA Z535.3.

4. Product Safety Signs and Labels: NEMA Z535.4.
5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

C. Electrical Hazard Warnings:

1. Multiple Power Sources Warning Legend: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. OSHA Workspace Clearance Warning Legend: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."

D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to the exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.
b. Controls with external control power connections.

E. Operating Instruction Signs: Self-adhesive labels.

F. Emergency Operating Instruction Signs: Self-adhesive label with white legend on red background with minimum 3/8 inch high letters for emergency instructions at equipment used for power transfer.

3.04 SELECTION OF IDENTIFICATION PRODUCTS FOR COMMUNICATIONS, CONTROL, AUXILIARY, AND LIFE SAFETY SYSTEMS

A. Comply with Section 270528 "Pathways for Communications Systems".

3.05 INSTALLATION

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes typical for electrical equipment environments specified in Section 260011 "Facility Performance Requirements for Electrical."

C. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless-steel machine screws with nuts and flat and lock washers.

D. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

E. Verify identity of items before installing identification products.

F. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

G. Apply identification devices to surfaces that require finish after completing finish work.

H. Install signs with an approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.

J. Vinyl Wraparound Labels:

1. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

K. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

L. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

M. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

N. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

O. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape not less than 12 inch directly above cables or raceways buried 18 inch or more below grade. Use multiple tapes where width of multiple lines installed in common trench exceeds 16 inch overall.
2. Install underground-line warning tape for direct-buried conductors and cables in raceways.

P. Nonmetallic Preprinted Tags:

1. Place in location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

END OF SECTION

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SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:

1. Transformer temporary heating, working clearances, anchoring, torque values, and insulation-resistance testing.

B. Source quality-control reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat in accordance with manufacturer's published instructions within enclosure of ventilated-type units, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of transformer from single source, from single manufacturer.

2.02 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60 Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by qualified electrical testing laboratory recognized by authorities having jurisdiction.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside transformer enclosure.

2.03 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume must allow efficient transformer operation at 10 percent above nominal tap voltage.
3. Grounded to enclosure.

C. Coils: Continuous windings without splices except for taps.

1. Coil Material: Aluminum.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded.

D. Encapsulation: Transformers smaller than 30 kVA must have core and coils completely resin encapsulated.

E. Enclosure: Ventilated.

1. Core and coil must be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Environmental Protection:

    a. Indoor: UL 50E, Type 2.

5. Finish Color: Gray weather-resistant enamel.

F. Taps for Transformers 3 kVA and Smaller: None.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.

I. Grounding: Provide ground-bar kit or ground bar installed on the inside of transformer enclosure.

J. Wall Brackets: Manufacturer's standard brackets.

2.04 IDENTIFICATION

A. Nameplates:

1. Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.05 SOURCE QUALITY CONTROL

A. Factory Tests and Inspections: Test and inspect assembled system, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.01 and IEEE C57.12.91 before delivering to site. Affix label with name and date of manufacturer's certification of system compliance on control units.

1. Resistance measurements of windings at rated voltage connections and at tap connections.
2. Ratio tests at rated voltage connections and at tap connections.
3. Phase relation and polarity tests at rated voltage connections.
4. No load losses, and excitation current and rated voltage at rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:

    a. Line-side to ground.
    b. Load-side to ground.
    c. Line-side to load-side.

9. Temperature tests.

B. Nonconforming Work:

1. System equipment that does not pass tests and inspections will be considered defective.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.

B. Verify that field measurements are needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 Ω at location of transformer.

E. Environment: Enclosures must be rated for the environment in which they are located

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install transformers level and plumb on concrete base with vibration-dampening supports. Provide clearance from the walls in accordance with the manufacturer’s instructions.

B. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Secure transformer to concrete base in accordance with manufacturer's published instructions.

D. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.03 CONNECTIONS

A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Small (Up to 167 kVA Single-Phase or 500 kVA Three-Phase) Dry-Type Transformer Field Tests:

a. Visual and Mechanical Inspection.

1) Inspect physical and mechanical condition.
2) Inspect anchorage, alignment, and grounding.
3) Verify that resilient mounts are free and that shipping brackets have been removed.
4) Verify that unit is clean.
5) Perform specific inspections and mechanical tests recommended by manufacturer.
6) Verify that as-left tap connections are as specified.
7) Verify presence of surge arresters and that their ratings are as specified.

b. Electrical Tests:

1) Measure resistance at windings, taps, and bolted connections.
2) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5.
3) Perform turns-ratio tests at tap positions. Test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
4) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

B. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested components.

C. Nonconforming Work:

1. Transformer will be considered defective if it does not pass tests and inspections.
2. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Assemble and submit test and inspection reports.

3.05 ADJUSTING

A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than

nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.06 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.07 MAINTENANCE

A. Infrared Scanning: Two months after Substantial Completion, perform infrared scan of transformer connections.

1. Use infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Prepare certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Disconnecting and overcurrent protective devices.

1.02 DEFINITIONS

A. GFEP: Ground-fault equipment protection.

B. MCCB: Molded-case circuit breaker.

C. VPR: Voltage protection rating.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Disconnecting and overcurrent protective devices.
4. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
5. 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.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.05 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.

B. Sample warranties.

1.06 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation in accordance with NECA 407.

1.09 WARRANTY

A. Special Manufacturer Extended Warranty: Manufacturer warrants that panelboards perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.

1. Initial Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

A. 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.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing agency recognized by authorities having jurisdiction, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: UL 50E, Type 1.

2. Height: 7 ft maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims must cover live parts and may have no exposed hardware.
4. Finishes:

a. Panels and Trim: Steel and galvanized 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: Same finish as panels and trim.

F. Incoming Mains:

1. Location: Top.
2. Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.

a. Plating must run entire length of bus.
b. Bus must be fully rated for entire length.

2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Terminations must allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with lug on neutral bar for each pole in panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with lug on bar for each pole in panelboard.

I. Future Devices: Panelboards must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

J. Panelboard Short-Circuit Current Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.

a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

K. Surge Suppression: Factory installed as integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.02 POWER PANELBOARDS

A. Listing Criteria: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inch high, provide two latches, keyed alike.

C. Mains: Lugs only.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Listing Criteria: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: As indicated on Drawings.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Door-in-door construction with concealed hinges; secured with flush latch with tumbler lock; keyed alike. Outer door must permit full access to panel interior. Inner door must permit access to breaker operating handles and labeling, but current carrying terminals and bus must remain concealed.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.

2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
3. GFEP Circuit Breakers: Class B ground-fault protection (30 mA trip).
4. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
f. Multipole units enclosed in single housing with single handle.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards in accordance with NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NECA 407.
2. Consult Owner for resolution of conflicting requirements.

C. Special Techniques:

1. Equipment Mounting:

   a. Attach panelboard to vertical finished or structural surface behind panelboard.
   b. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
3. Mount top of trim 7 ft above finished floor unless otherwise indicated.
4. Mount panelboard cabinet plumb and rigid without distortion of box.
5. Install overcurrent protective devices and controllers not already factory installed.

   a. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.

6. Make grounding connections and bond neutral for services and separately derived systems to ground
7. Install filler plates in unused spaces.
8. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

D. Interfaces with Other Work:

1. 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.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.

F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.

G. Circuit Directory:

1. Provide a directory card inside panelboard door, mounted in transparent card holder.

a. Circuit directory must identify specific purpose with sufficient detail to distinguish it from other circuits.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Do not perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Instruments and Equipment:

1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Nonconforming Work:

1. Panelboards will be considered defective if they do not pass tests and inspections.

2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

3.06 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature in accordance with manufacturer's published instructions.

END OF SECTION

SECTION 262713 - ELECTRICITY METERING

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 equipment for electricity metering by utility company.

1.3 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center according to NECA 400.

1.7 COORDINATION

A. Electrical Service Connections: Coordinate with utility company and components they furnish as follows:

1. Comply with requirements of utility providing electrical power services.
2. Coordinate installation and connection of utility service, including provision for electricity-metering components.

3. Coordinate with utility for inspection and acceptance of installation; utility normally terminates Contractor installed Utility Metering wiring.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by the utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

END OF SECTION 262713

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. General-use switches.
2. Receptacles with ground-fault protective devices.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. General-use switches.
2. Receptacles with ground-fault protective devices.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 GENERAL-USE SWITCHES

A. Toggle Switch :

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN WMUZ and UL 20.

3. Options:

    a. Device Color: Gray.
    b. Configuration:

        1) General-duty, 120-277 V, 20 A, single pole.

4. Accessories:

    a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.02 RECEPTACLES WITH GROUND-FAULT PROTECTIVE DEVICES

A. General-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device :

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

    a. Reference Standards: UL CCN KCXX, UL 498, UL 943, UL 1699, and UL Subject 1699A.

3. Options:

    a. Device Color: Gray.
    b. Configuration: Heavy-duty, NEMA 5-20R.

4. Accessories:

    a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. General-Grade, Weather-Resistant, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device :

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

    a. Reference Standards: UL CCN KCXS, UL 498, and UL 943.

3. Options:

    a. Device Color: Gray.
    b. Configuration: Heavy-duty, NEMA 5-20R.

4. Accessories:

    a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

PART 3 - EXECUTION

3.01 INSTALLATION OF SWITCHES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Consult Engineer for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

3.02 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
4. Consult Owner for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

3.03 FIELD QUALITY CONTROL OF SWITCHES

A. Tests and Inspections:

1. Perform tests and inspections in accordance with manufacturers' instructions.

B. Nonconforming Work:

1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Assemble and submit test and inspection reports.

3.04 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

A. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.
2. Verify polarity of hot and neutral pins.
3. Measure line voltage.
4. Measure percent voltage drop.
5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.
7. GFCI Trip: Test for tripping values specified in UL 1436 and UL943.

B. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Assemble and submit test and inspection reports.

3.05 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Enclosures.

1.02 DEFINITIONS

A. GFEP: Ground-fault circuit-interrupter for equipment protection.

B. GFLS: Ground-fault circuit-interrupter for life safety.

C. SPDT: Single pole, double throw.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data:

1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
2. Enclosure types and details for types other than UL 50E, Type 1.
3. Current and voltage ratings.
4. Short-circuit current ratings (interrupting and withstand, as appropriate).
5. Include evidence of qualified electrical testing laboratory listing for series rating of installed devices.
6. 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.

1. Include wiring diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.05 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.06 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts, for repairing enclosed switches and circuit breakers, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Source Limitations: Obtain products 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 in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.02 FUSIBLE SWITCHES

A. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.

3. 600 V(ac).
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. 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.

2.03 NONFUSIBLE SWITCHES

A. Type GD, General Duty, Three Pole, Single Throw, 240 V(ac), 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600 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. 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.

2.04 MOLDED-CASE CIRCUIT BREAKERS

A. Circuit breakers must be constructed using glass-reinforced insulating material. Current carrying components must be completely isolated from handle and accessory mounting area.

B. Circuit breakers must have toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. Circuit-breaker handle must be over center, be trip free, and reside in tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon must be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with push-to-trip button, located on face of circuit breaker to mechanically operate circuit-breaker tripping mechanism for maintenance and testing purposes.

C. Maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings must be clearly marked on face of circuit breaker.

D. MCCBs must be equipped with a device for locking in isolated position.

E. Lugs must be suitable for 75 deg C rated wire or 90 deg C rated wire, sized in accordance with 75 deg C temperature rating in NFPA 70.

F. Standard: Comply with UL 489 with the required interrupting capacity for available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. GFEP Circuit Breakers: With Class B ground-fault protection (30 mA trip).

I. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
3. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
4. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
5. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
6. Electrical Operator: Provide remote control for on, off, and reset operations.

2.05 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: Enclosure must be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (UL 50E Type 1) or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (UL 50E Types 3R, 12).

C. Conduit Entry: UL 50E Types 4, 4X, and 12 enclosures may not contain knockouts. UL 50E Types 7 and 9 enclosures must be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: Circuit-breaker operating handle must be directly operable through front cover of enclosure (UL 50E Type 1) or directly operable through dead front trim of enclosure (UL 50E Type 3R). Cover interlock mechanism must have externally operated override. Override may not permanently disable interlock mechanism, which must return to locked position once override is released. Tool used to override cover interlock mechanism must not be required to enter enclosure in order to override interlock.

E. Enclosures designated as UL 50E Type 4, 4X stainless steel, 12, or 12K must have dual cover interlock mechanism to prevent unintentional opening of enclosure cover when circuit breaker is ON and to prevent turning circuit breaker ON when enclosure cover is open.

PART 3 - EXECUTION

3.01 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.

1. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

3.02 SELECTION OF ENCLOSURES

A. Indoor, Dry and Clean Locations: UL 50E, Type 1.

B. Outdoor Locations: UL 50E, Type 3SX.

C. Other Wet or Damp, Indoor Locations: UL 50E, Type 3R .

D. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL 50E, Type 12.

3.03 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Special Techniques:

1. 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.
2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
3. Install fuses in fusible devices.

3.04 IDENTIFICATION

A. Comply with requirements in Section 260553 "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.

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify correct phase barrier installation.
i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

B. Tests and Inspections for Molded-Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform contact/pole resistance test. Drop values may not exceed the high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
d. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset trip logs and indicators. Investigate units that do not function as designed.

3. Test and adjust controls, remote monitoring, and safeties.

C. Nonconforming Work:

1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

3.07 PROTECTION

A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.08 MAINTENANCE

A. Infrared Scanning of Enclosed Switches and Breakers: Two months after Substantial Completion, perform infrared scan of joints and connections. Remove covers so joints and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison.

1. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Report: Prepare a certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION

SECTION 262913.03 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Combination full-voltage magnetic motor controllers.
2. Enclosures.
3. Accessories.
4. Identification.

1.03 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. NC: Normally closed.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SCPD: Short-circuit protective device.

1.04 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signals, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.
6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.

a. Listing document proving Type 2 coordination.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Routine maintenance requirements for magnetic controllers and installed components.

b. Manufacturer's written instructions for setting field-adjustable overload relays.
c. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
d. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.08 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. Fuses for Fused Switches: Equal to 3 for each size and type.
2. Control Power Fuses: No fewer than two of each size and type.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry spaces with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers.

1.10 FIELD CONDITIONS

A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 23 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.01 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 use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.02 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

A. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.

B. Standard: Comply with NEMA ICS 2, general purpose, Class A.

C. Configuration: Nonreversing.

D. Contactor Coils: Pressure-encapsulated type.

1. Operating Voltage: Manufacturer's standard, unless indicated.

E. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.

a. Spare CPT Capacity as Indicated on Drawings: 50 VA.

F. Overload Relays:

1. Solid-State Overload Relay:

a. Switch or dial selectable for motor-running overload protection.
b. Sensors in each phase.
c. Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

G. Fusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

H. Nonfusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.03 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

2.04 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty.

a. Push Buttons: As indicated in the controller schedule.
b. Pilot Lights: As indicated in the controller schedule.

2.05 IDENTIFICATION

A. Controller Nameplates: Laminated acrylic or melamine plastic signs, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
2. Visual and Mechanical Inspection:

    a. Compare equipment nameplate data with drawings and specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, and grounding.
    d. Verify the unit is clean.
    e. Inspect contactors:

        1) Verify mechanical operation.
        2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

    f. Motor-Running Protection:

        1) Verify overload element rating is correct for its application.
        2) If motor-running protection is provided by fuses, verify correct fuse rating.

    g. Inspect bolted electrical connections for high resistance using one of the two following methods:

        1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
        2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

    h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

3. Electrical Tests:

    a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than those of this table or manufacturer's recommendations shall be investigated and corrected.
    b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
    c. Test motor protection devices according to manufacturer's published data.

d. Perform operational tests by initiating control devices.

4. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.

a. Comply with the recommendations of NFPA 70B, "Testing and Test Methods" Chapter, "Infrared Inspection" Article.
b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
c. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:

1) Description of equipment to be tested.
2) Discrepancies.
3) Temperature difference between the area of concern and the reference area.
4) Probable cause of temperature difference.
5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
6) Load conditions at time of inspection.
7) Photographs and thermograms of the deficient area.
8) Recommended action.

d. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
e. Act on inspection results and recommended action, and considering the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

C. Motor controllers will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controllers will be considered defective if it does not pass the system function tests and inspections.

C. Prepare test and inspection reports.

3.06 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchgear.

END OF SECTION

SECTION 262923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.02 DEFINITIONS

A. CE: Conformite Europeene (European Compliance).

B. CPT: Control power transformer.

C. DDC: Direct digital control.

D. EMI: Electromagnetic interference.

E. LED: Light-emitting diode.

F. NC: Normally closed.

G. NO: Normally open.

H. OCPD: Overcurrent protective device.

I. PID: Control action, proportional plus integral plus derivative.

J. RFI: Radio-frequency interference.

K. VFC: Variable-frequency motor controller.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated.

1. Include dimensions and finishes for VFCs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated.

1. Include mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each VFC from manufacturer.

B. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
b. Manufacturer's written instructions for setting field-adjustable overload relays.
c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.07 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. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.08 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.09 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. General Requirements for VFCs:

1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508A.

B. Application: variable torque.

C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

F. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 3 percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: 22.
7. Ambient Temperature Rating: Not less than 32 deg F and not exceeding 104 deg F.
8. Humidity Rating: Less than 95 percent (noncondensing).
9. Altitude Rating: Not exceeding 3300 feet.
10. Vibration Withstand: Comply with NEMA ICS 61800-2.
11. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
13. Speed Regulation: Plus or minus 5 percent.
14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

G. Inverter Logic: Microprocessor based, 16 bit, isolated from all power circuits.

H. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.

I. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 999.9 seconds.
4. Deceleration: 0.1 to 999.9 seconds.
5. Current Limit: 30 to a minimum of 150 percent of maximum rating..

J. Self-Protection and Reliability Features:

1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 2.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor-overtemperature fault.
12. Motor overload protection according to NEC article 430.

K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

L. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

M. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

P. Integral Input Disconnecting Means and OCPD: NEMA KS 1, fusible switch with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.

2.02 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.

6. External fault..

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac)..

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

a. A minimum of two programmable analog inputs: 0- to 10-V dc and 4- to 20-mA dc.
b. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the SCADA control system:

a. 0- to 10-V dc.
b. 4- to 20-mA dc.

3. Output Signal Interface: A minimum of one programmable analog output signal(s) (4- to 20-mA dc), which can be configured for any of the following:

    a. Output frequency (Hz).
    b. Output current (load).
    c. DC-link voltage (V dc).
    d. Motor torque (percent).
    e. Motor speed (rpm).
    f. Set point frequency (Hz)..

4. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

    a. Motor running.
    b. Set point speed reached.
    c. Fault and warning indication (overtemperature or overcurrent).
    d. PID high- or low-speed limits reached..

2.03 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519 recommendations.

B. EMI/RFI Filtering:

1. CE marked; certify compliance with IEC 61800-3 for Category C2.

2.04 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Indoor Locations: Type 12.
2. Outdoor Locations: Type 4X.

2.05 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to a motor that is comparable to that for which the VFC is rated.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch VFC.

D. Install fuses in control circuits if not factory installed.

E. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

F. Comply with NECA 1.

3.03 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

3.04 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
    b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. VFCs will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.06 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.07 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

3.08 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 262923

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Diesel-engine-driven generator sets.
2. Diesel engine.
3. Diesel fuel-oil system.
4. Control and monitoring.
5. Generator overcurrent and fault protection.
6. Generator, exciter, and voltage regulator.
7. Load bank.
8. Vibration isolation devices.

B. Related Requirements:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.02 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include airflow requirements for cooling and combustion air in cubic feet per minute at 0.8 power factor, with air-supply temperature of 95, 80, 70, and 50 deg F. Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.

6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

C. Field quality-control reports.

D. Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. Include the following:

a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
b. Operating instructions laminated and mounted adjacent to generator location.
c. Training plan.

1.07 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. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operations and maintenance manual.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.09 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 DIESEL-ENGINE-DRIVEN GENERATOR SETS

A. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 110 requirements for Level 1 EPSS.

C. UL Compliance: Comply with UL 2200.

D. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.

E. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 104 deg F.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet.

2.03 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

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 use.

C. Power Rating: Standby.

D. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.

E. EPSS Class: Engine generator shall be classified as a Class 72 according to NFPA 110.

F. Service Load: 125 kVA.

G. Power Factor: 0.8, lagging.

H. Frequency: 60 Hz.

I. Voltage: 480-V ac.

J. Phase: Three-phase, four wire, wye.

K. Induction Method: Naturally aspirated or turbocharged.

L. Governor: Adjustable isochronous, with speed sensing.

M. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.

N. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

O. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time:

    a. Comply with NFPA 110, Type 10 system requirements.

2.04 DIESEL ENGINE

A. Fuel: Diesel fuel oil, Grade DF-1.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499 and with NFPA 110 requirements for Level 1 equipment for heater capacity.

E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer:

1. Commercial type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

a. Minimum sound attenuation of 12 dB at 500 Hz.
b. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 90 dBA or less.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Stand: Factory-fabricated, metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.05 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 37.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 1 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Fuel-Oil Storage Tank: Comply with requirements in Section 231323 "Facility Aboveground Fuel-Oil Storage Tanks."

1. Fuel Tank Capacity: 500 gallons.
2. Coordinate with Mechanical.

G. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:

1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
2. Tank Capacity 75 gallons.
3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
5. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.
6. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.

2.06 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

C. Comply with UL 508A.

D. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.

E. Control and Monitoring Panel:

1. Digital engine generator controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gage.
    b. Engine-coolant temperature gage.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, for each phase.
    f. AC ammeter, for each phase.
    g. AC frequency meter.
    h. Generator-voltage adjusting rheostat.

3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low-water temperature alarm.
    g. High engine temperature prealarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Low fuel main tank.

        1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required in "Fuel Tank Capacity". Coordinate with the Engineer

    m. Coolant low-level alarm.
    n. Coolant low-level shutdown device.
    o. Coolant high-temperature prealarm.
    p. Coolant high-temperature alarm.
    q. Coolant low-temperature alarm.
    r. Coolant high-temperature shutdown device.
    s. EPS load indicator.
    t. Battery high-voltage alarm.
    u. Low cranking voltage alarm.
    v. Battery-charger malfunction alarm.

w. Battery low-voltage alarm.
x. Lamp test.
y. Contacts for local and remote common alarm.
z. Remote manual stop shutdown device.
aa. Generator overcurrent-protective-device not-closed alarm.
bb. Hours of operation.
cc. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

F. Connection to Datalink:

1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.

G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

H. Remote Emergency-Stop Switch: Flush; wall mounted unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:

1. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:

a. Tripping Characteristic: Designed specifically for generator protection.
b. Trip Rating: Matched to generator output rating.
c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

C. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other engine generator alarm indications.

2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six-lead alternator.

E. Range: Provide extended range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 20 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.09 LOAD BANK

A. Description:

1. Permanent, radiator-mounted, resistive unit capable of providing a balanced three-phase, delta-connected load to engine generator at 50 percent rated-system capacity. Unit shall be capable of selective control of load in 25 percent steps of load-bank rating and with minimum step changes of approximately 5 and 10 percent available.

B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and stainless-steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases. Galvanized steel is prohibited. Element's maximum resistance shall be between 100 and 105 percent of rated resistance.

C. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.

D. Load-Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.

E. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.

F. Load-Bank Enclosures: NEMA 250, Type 3R, aluminized steel complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow shall be screened with 1/2-inch- square, galvanized-steel mesh. Reactive load bank shall include automatic shutters at air intake and discharge. Components other than resistive elements shall receive exterior epoxy coating with compatible primer. Comply with requirements in Section 099600 "High-Performance Coatings."

G. Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with generator circuit breaker. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000-A interrupting capacity.

H. Load-Bank Remote-Control Panel: Separate from load bank in NEMA 250, Type 1 enclosure with a control power switch and pilot light, and switches controlling groups of load elements.

I. Control Sequence: Control panel may be preset for adjustable single-step loading of generator during automatic exercising.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene separated by steel shims.

B. Comply with requirements in Section 233100 "HVAC Ducts and Casings" for vibration isolation and flexible connector materials for exhaust shroud and ductwork.

C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115 and with NFPA 110, Level 1 Energy Converters.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.
9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
10. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
3. Install packaged engine generator with elastomeric isolator pads on 4-inch- high concrete base. Secure set to anchor bolts installed in concrete bases.

D. Exhaust System: Reference section “232416 - Internal-Combustion Engine Exhaust Piping.”. Install thimble at roof. Piping shall be same diameter as muffler outlet.

1. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches of clearance from combustibles.

2. Install insulation on the silencer and exhaust pipes from the silencer to the exterior surface isolating thimble.

E. Drain Piping: Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.

F. Fuel Piping:

1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Section 231113 "Facility Fuel-Oil Piping."
2. Copper and galvanized steel shall not be used in the fuel-oil piping system.

G. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Connect fuel piping to engines with a gate valve and union and flexible connector.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

3.04 IDENTIFICATION

A. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.05 FIELD QUALITY CONTROL

A. Testing Agency:

1. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

a. Visual and Mechanical Inspection:

1) Compare equipment nameplate data with Drawings and Specifications.
2) Inspect physical and mechanical condition.
3) Inspect anchorage, alignment, and grounding.
4) Verify that the unit is clean.

b. Electrical and Mechanical Tests:

1) Perform insulation-resistance tests according to IEEE 43.

a) Machines Larger Than 200 hp: Test duration shall be 10 minutes. Calculate polarization index.
b) Machines 200 hp or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.

2) Test protective relay devices.
3) Verify phase rotation, phasing, and synchronized operation as required by the application.
4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
5) Perform vibration test for each main bearing cap.
6) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from engine generator installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's authorized service representative. Include quarterly preventive maintenance and exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Parts shall be manufacturer's authorized replacement parts and supplies.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

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SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Contactor-type automatic transfer switches.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Contactor-type automatic transfer switches.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.

C. Shop Drawings:

1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
2. Include material lists for each switch specified.
3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer-authorized service representative.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Features and operating sequences, both automatic and manual.
b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.06 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 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. Comply with NEMA ICS 1.

C. Comply with NFPA 110.

D. Comply with UL 1008 unless the requirements of these Specifications are stricter.

E. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

F. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
1. Short-time withstand capability for three cycles.

G. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

H. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1. Comply with service entrance, Type 1 classification.

I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

J. Neutral Terminal: Solid and fully rated unless otherwise indicated.

K. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

L. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
4. Accessible via front access.

M. Enclosures: General-purpose NEMA 250, Type 12, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.02 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching.
4. Conductor Connectors: Suitable for use with conductor material and sizes.
5. Material: Tin-plated aluminum.
6. Main and Neutral Lugs: Mechanical type.
7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
8. Ground bar.
9. Connectors shall be marked for conductor size and type according to UL 1008.

C. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.

1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
3. Fully automatic break-before-make operation with center off position.
4. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.

D. Manual Switch Operation, Load-Breaking: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Automatic Transfer-Switch Controller Features:

1. Controller operates through a period of loss of control power.
2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts:

    a. Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is unavailable.

2.03 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.

1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
3. Provide workspace and clearances required by NFPA 70.

B. Identify components according to Section 260553 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

D. Comply with NECA 1.

3.02 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets,control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Wiring Method: Install cables in raceways except within electrical enclosures.

1. Comply with requirements for raceways specified in Section 260533.13 "Conduits for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Connect twisted pair cable according to Section 260523 "Control-Voltage Electrical Power Cables."

G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.03 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:

1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. After installing equipment, test for compliance with requirements according to NETA ATS.
2. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with Drawings and Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and required clearances.
d. Verify that the unit is clean.
e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
f. Verify that manual transfer warnings are attached and visible.
g. Verify tightness of all control connections.

h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:

1) Use of low-resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.

i. Perform manual transfer operation.
j. Verify positive mechanical interlocking between normal and alternate sources.
k. Perform visual and mechanical inspection of surge arresters.
l. Inspect control power transformers.

1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

3. Electrical Tests:

a. Perform insulation-resistance tests on all control wiring with respect to ground.
b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
c. Verify settings and operation of control devices.
d. Calibrate and set all relays and timers.
e. Verify phase rotation, phasing, and synchronized operation.
f. Perform automatic transfer tests.
g. Verify correct operation and timing of the following functions:

1) Normal source voltage-sensing and frequency-sensing relays.
2) Engine start sequence.
3) Time delay on transfer.
4) Alternative source voltage-sensing and frequency-sensing relays.
5) Automatic transfer operation.
6) Interlocks and limit switch function.
7) Time delay and retransfer on normal power restoration.
8) Engine cool-down and shutdown feature.

4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Transfer switches will be considered defective if they do not pass tests and inspections.

F. Remove and replace malfunctioning units and retest as specified above.

G. Prepare test and inspection reports.

H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Coordinate this training with that for generator equipment.

END OF SECTION

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SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Luminaires.
2. Luminaire fittings.

B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables" specifies wiring connections installed by this Section.
2. Section 260529 "Hangers and Supports for Electrical Systems" specifies channel and angle supports installed by this Section.
3. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.

1.02 DEFINITIONS

A. BUG Rating: Backlight, uplight, and glare rating for light pollution from exterior luminaires.

B. Correlated Color Temperature (CCT): The absolute temperature (in kelvins) of a blackbody whose chromaticity (color quality) most nearly resembles that of the light source.

C. Color Rendering Index (CRI): The measure of the degree of color shift objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference light source. The lower the CRI of a light source, the more difficult it is to identify colors and stripes on electronic components and wiring.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data:

1. For luminaires.

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Product Certificates: Include product certificates stating compliance with standards listed below, signed by manufacturer or fabricator.

1) Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with current accreditation under National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

c. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
d. Include operating characteristics, electrical characteristics, and furnished accessories.
e. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on Drawings.
f. Include battery and charger data for emergency lighting units.
g. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
h. Include photometric data and adjustment factors obtained from qualified laboratory tests.
i. Include manufacturer's sample warranty language.

2. For luminaire fittings.

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.

2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
c. Include operating characteristics, electrical characteristics, and furnished accessories.
d. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on Drawings.
e. Include manufacturer's sample warranty language.

B. Field quality-control reports.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturers' published instructions.

B. Field Reports:

1. Manufacturer's field reports for field quality-control support.
2. Manufacturer's field reports for system startup support.

1.06 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect exposed surface finishes on lighting equipment by applying strippable, temporary protective covering before shipping.

1.08 WARRANTY FOR LUMINAIRES

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed luminaires perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.

1. Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

1.09 WARRANTY FOR BATTERIES

A. Special Manufacturer Extended Warranty for Batteries: Manufacturer warrants that batteries perform in accordance with specified requirements and agrees to provide repair or replacement of batteries that fail to perform as specified within extended-warranty period.

1. Initial Extended-Warranty Period for Li-ion Batteries: Three years from date of Substantial Completion; full coverage for materials only, free on board destination, freight prepaid.

PART 2 - PRODUCTS

2.01 LUMINAIRES

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. See individual product types below for listing criteria.
c. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.

B. Source Quality Control:

1. Compile and submit product data.
2. Compile and submit sustainable design product data.

C. Surface-Mounted Luminaire:

1. Source Limitations: Obtain products for this luminaire type from single manufacturer.
2. Product Listing Criteria, LED: UL CCN IFAM; including UL 1598.
3. Product Characteristics:

a. Openings: Doors, frames, and access panels must operate smoothly, not leak light under operating conditions, and permit maintenance without use of tools or parts falling from enclosure.
b. Nominal Operating Voltage: 120 V(ac).
c. Nominal Luminaire Operating Power Rating: 20 to 60 W.
d. CRI: 80+.
e. Driver Location: Internal.

4. Required Product Options:

a. Mounting Hardware: Ceiling-mounted, Pendant-mounted, or Wall-mounted; with stainless steel mounting brackets,.
b. Dimmable from 100 percent to zero percent of maximum light output.

c. EMI Filters: Factory installed to suppress conducted EMI in accordance with MIL-STD-461E. Fabricate luminaires with one filter on each ballast requiring filter.
d. Stainless steel latches.
e. Integral pressure equalizer.

5. Installation Markings:

a. All Luminaires (UL CCN HYXT):

1) Marked with mounting orientation, such as "THIS END UP."
2) "60 Hz" or "AC ONLY."
3) Marked to identify voltage supply or type of branch circuit or both.

b. LED Luminaires (UL CCN IFAM):

D. UL FTBR or FTBV - Emergency Lighting and Power Equipment:

1. Source Limitations: Obtain products from single manufacturer.
2. Product Listing Criteria: UL CCN FTBR or UL CCN FTBV; including UL 924, NFPA 101, and ICC IBC.
3. Product Characteristics:

a. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
b. Status and Test Indication: Visible and accessible without opening luminaire or entering ceiling space.

1) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
2) Test Push-Button: Push-to-test button in unit housing simulates loss of normal power and demonstrates unit operability.

c. Nominal Operating Voltage: 120 V(ac).

4. Required Product Options:

a. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with driver.

1) Emergency Connection: Operate continuously at a minimum output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire driver.
2) 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.
3) Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

a) Push-Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
b) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4) Battery Type: Li-ion.
5) Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

5. Installation Markings:

a. All Luminaires (UL CCN HYXT):

1) Marked to identify voltage supply or type of branch circuit or both.

b. Emergency Lighting and Power Equipment (UL CCN FTBR):

2.02 LUMINAIRE FITTINGS

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. See individual product types below for listing criteria.

B. Source Quality Control:

1. Compile and submit product data.
2. Compile and submit sustainable design product data.
3. Compile and submit samples.

C. Luminaire Support Accessories:

1. Product Characteristics:

a. Sized and rated for luminaire weight.
b. Capable of maintaining luminaire position after cleaning and maintenance.
c. Capable of supporting luminaire without causing deflection of ceiling or wall.
d. Capable of supporting horizontal force equal to 100 percent of luminaire weight and vertical force equal to 400 percent of luminaire weight.

PART 3 - EXECUTION

3.01 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. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Lighting: If approved by Engineer, specified luminaires for Project may be installed for temporary lighting. Install and energize minimum quantity of luminaires necessary to meet needs of construction activities. When construction is sufficiently complete, remove, disassemble, clean, and relamp luminaires used for temporary lighting before reinstalling for Project delivery.

3.03 INSTALLATION OF LIGHTING

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Installation of Indoor Lighting Systems: NECA NEIS 500.
2. Installation of Exterior Lighting Systems: NECA NEIS 501.
3. Installation of Industrial Lighting Systems: NECA NEIS 502.
4. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.
5. Consult Owner for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
2. Install luminaires at height and aiming angle as indicated on Drawings.
3. Coordinate layout and installation of luminaires with other construction.
4. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

5. Exterior Corrosion Prevention:

    a. Do not use aluminum in contact with earth or concrete. When in direct contact with dissimilar metals, protect aluminum with insulating fittings or treatment.
    b. When embedding steel conduits in concrete, wrap conduit with 10 mil thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

6. Wall-Mounted Luminaire Support:

    a. Attached to a minimum 1/8 inch backing plate attached to wall structural members.
    b. Do not attach luminaires directly to gypsum board.

7. Suspended Luminaire Support:

    a. Ceiling Mount:

        1) Chain or aircraft cables.

8. Install wiring connections for luminaires.
9. Identification: Provide labels for luminaires and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Provide warning signs.
    c. Label each enclosure with engraved metal or laminated-plastic nameplate.

D. Systems Integration: Integrate lighting control devices and equipment with electrical power connections for operation of luminaires as specified.

3.04 FIELD QUALITY CONTROL OF LIGHTING

A. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
4. Verify operation of photoelectric controls.
5. Exterior Illumination Tests:

    a. Measure light intensities at night. Use photometers with calibration referenced to NIST standards.

B. Nonconforming Work:

1. Luminaire will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.05 SYSTEM STARTUP

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.
2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.06 ADJUSTING

A. Luminaire Aiming Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aiming direction of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
3. Adjust aim of luminaires in presence of Architect.

3.07 PROTECTION

A. After installation, protect lighting equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

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SECTION 265613 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel poles.
2. Pole accessories.
3. Mounting hardware.

1.02 DEFINITIONS

A. EPA: Equivalent projected area.

B. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

C. Standard: See "Pole."

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements:

1. American Iron and Steel (AIS).
2. Build America, Buy America Act.

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data:

1. Steel poles.
2. Pole accessories.
3. Mounting hardware.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of poles and pole accessories.
4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations.

5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

C. Field quality-control reports.

1.05 INFORMATIONAL SUBMITTALS

A. Material Test Reports:

1. For each pole, by qualified testing laboratory.

B. Manufacturers' published instructions.

C. Field Reports:

1. Manufacturer's field reports for field quality-control support.

1.06 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant skids at least 12 inch above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.08 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed pole(s) perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: Three years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that pole(s) perform in accordance with specified requirements and agrees to provide repair or replacement of products that fail to perform as specified within extended-warranty period, including materials that corrode, fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Extended-Warranty Period: Five years from date of Substantial Completion; full coverage for labor, materials, and equipment.

2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion; full coverage for labor, materials, and equipment.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-6-M.

B. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied in accordance with AASHTO LTS-6-M.

C. Live Load: Single load of 500 lb distributed in accordance with AASHTO LTS-6-M.

D. Ice Load: Load of 3 lb/ft^2, applied in accordance with AASHTO LTS-6-M for applicable areas on the Ice Load Map.

E. Wind Load for Poles Not Exceeding 50 ft (15 m) Height:

1. Basic Wind Speed: 100 mile/hr.
2. Wind Importance Factor: 1.0.
3. Minimum Design Life: 25 years.
4. Velocity Conversion Factor: 1.0.

F. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA used in pole selection strength analysis.

G. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless steel fasteners and mounting bolts unless otherwise indicated.

H. General Finish Requirements:

1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. 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.

2.02 STEEL POLES

A. Source Limitations: Obtain poles from single manufacturer or producer

B. Carbon-Steel Poles: Comply with ASTM A500/A500M, Grade B carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 ft in height with access handhole in pole wall.

1. Shape: Round, straight.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

E. Grounding and Bonding Lugs: Welded 1/2 inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

F. Handhole: Oval shaped, with minimum clear opening of 2-1/2-by-5 inch, with cover secured by stainless steel captive screws.

G. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces in accordance with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder Coat: Comply with AAMA 2604.

a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5 to 3.5 mil dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
b. Color: As indicated in the Drawings.

2.03 POLE ACCESSORIES

A. Bullhorn brackets as indicated in the Drawings.

2.04 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to ASTM F1554, Grade 55**,** with a minimum yield strength of 55,000 psi.

1. Galvanizing: Hot dip galvanized in accordance with ASTM A153, Class C
2. Bent rods.
3. Threading: Uniform National Coarse, Class 2A.

B. Nuts: ASTM A563, Grade A, Heavy-Hex.

1. Galvanizing: Hot dip galvanized in accordance with ASTM A153, Class C
2. Four nuts provided per anchor bolt.

C. Washers: ASTM F436, Type 1.

1. Galvanizing: Hot dip galvanized in accordance with ASTM A153, Class C
2. Two washer(s) provided per anchor bolt.

2.05 SOURCE QUALITY CONTROL

A. Product Data: Prepare and submit catalog cuts, brochures and performance data illustrating size, physical appearance, and other characteristics of product.

1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
2. Include finishes for lighting poles and luminaire-supporting devices.
3. Anchor bolts.
4. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in accordance with AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design.
5. Include sample warranty language.

B. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

PART 3 - EXECUTION

3.01 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 poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor Bolts: Install plumb using manufacturer-supplied template, uniformly spaced.

3.03 POLE INSTALLATION

A. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.

1. Fire Hydrants and Water Piping: 60 inches.
2. Water, Electric, Communications, and Sewer Lines: 10 ft.

B. Concrete Pole Foundations: Set anchor bolts in accordance with anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level in accordance with pole manufacturer's written instructions.

1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
2. Use a short piece of 1/2 inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

D. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.04 CORROSION PREVENTION

A. Steel Conduits: Comply with requirements in Section 260533.13 "Conduits for Electrical Systems." In concrete foundations, wrap conduit with 0.010 inch thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.05 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.

B. Nonconforming Work:

1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

END OF SECTION

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SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metallic and nonmetallic communications conduits and fittings.
2. Cable supports and positioning devices.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" specifies firestopping for communications pathways installed by this Section.

2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding conductors and connectors for communications pathways installed by this Section.
3. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers and supports for communications pathways installed by this Section.
4. Section 260533.13 "Conduits for Electrical Systems" specifies the following installed by this Section:

    a. Type EMT-S duct raceways and elbows.
    b. Type ERMC-S duct raceways, elbows, couplings, and nipples.
    c. Type FMC-S duct raceways.
    d. Type IMC duct raceways.
    e. Type LFMC duct raceways.
    f. Type PVC duct raceways and fittings.
    g. Type RTRC-BG duct raceways and fittings.
    h. Fittings for conduit, tubing, and cable.
    i. Electrically conductive corrosion-resistant compounds for threaded conduit.
    j. Solvent cements.

5. Section 260533.16 "Boxes and Covers for Electrical Systems" specifies the following installed by this Section:

    a. Metallic outlet boxes, device boxes, rings, and covers.
    b. Junction boxes and pull boxes.
    c. Cover plates for device boxes.
    d. Hoods for outlet boxes.

6. Section 260543 "Underground Ducts and Raceways for Electrical Systems" specifies the following installed by this Section:

    a. Handholes and boxes for exterior underground wiring.

7. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" specifies sleeves and sleeve seals for communications pathways installed by this Section.
8. Section 260553 "Identification for Electrical Systems" specifies labels and warning signs for communications pathways installed by this Section.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacture, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturers' published instructions submittals.

PART 2 - PRODUCTS

2.01 METALLIC CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2. Comply with TIA-569-D.

C. ERMC-S: Comply with ANSI C80.1 and UL 6.

D. Joint Compound for ERMC-S: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.

B. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Comply with TIA-569-D.

C. PVC-80: Comply with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Solvents and Adhesives: As recommended by conduit manufacturer.

PART 3 - EXECUTION

3.01 SELECTION OF PATHWAYS FOR COMMUNICATIONS SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Engineer for resolution of conflicting requirements.

B. Minimum Pathway Size:

1. For Copper and Aluminum Cables: Metric designator 21 (trade size 3/4).
2. For Optical-Fiber Cables: Metric designator 21 (trade size 3/4).

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. ERMC-S: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

D. Temperature Limitations:

1. Type PVC: Do not install where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.

E. Outdoor Pathways:

1. Exposed and Subject to Severe Physical Damage: ERMC.
2. Exposed and Subject to Physical Damage: ERMC.

    a. Locations less than 2.5 m (8 ft) above finished floor.

3. Exposed and Not Subject to Physical Damage: ERMC.
4. Direct Buried: PVC-80.

F. Indoor Pathways:

1. Exposed and Subject to Severe Physical Damage: ERMC. Locations include the following:

    a. Mechanical rooms.

2. Exposed and Subject to Physical Damage: ERMC. Locations include the following:

    a. Locations less than 2.5 m (8 ft) above finished floor.
    b. Stub-ups to above suspended ceilings.

3. Exposed and Not Subject to Physical Damage: ERMC.
4. Damp or Wet Locations: ERMC.

G. Boxes and Enclosures:

1. Outdoors, Aboveground: UL 50E Type 4.
2. Indoors: UL 50E Type 1, except use Type 4 stainless steel units in corrosive and damp or wet locations.

H. Identification of Underground Pathways, Handholes, and Structures:

1. Use "COMMUNICATIONS" for legend on warning planks, underground warning tape, and covers.

3.02 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

A. Color Coding Scheme for Communications Cable and Terminations: Comply with BICSI N1 and TIA-598.

B. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:

1. "COMMUNICATIONS."

C. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

D. Locations of Underground Lines: Underground-line warning tape for communication, control wiring, and optical-fiber cable.

E. Communications Vaults, Manholes, Handholes, and Pull and Junction Boxes: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with conductor designation.

H. Conductors To Be Extended in Future: Attach write-on tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

J. Horizontal Cables: Label each cable with a vinyl-wraparound label.

K. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Identify cover plate in accordance with TIA-606.

3.03 INSTALLATION OF PATHWAYS FOR COMMUNICATIONS SYSTEMS

A. Comply with manufacturers' published instructions, including limitations on distance, bends, and bend radius.

B. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101.
5. NECA 102.
6. NECA 105.

C. Special Installation Techniques:

1. Complete communications raceway installation before starting conductor installation.
2. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
3. Provide hangers and supports for pathways, boxes, and enclosures.
4. Firestop pathway penetrations of fire-rated assemblies.
5. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping..
6. Arrange stub-ups so curved portions of bends are not visible above finished slab.

7. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
8. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
9. Support conduit within 12 inches of enclosures to which attached.
10. Pathways Embedded in Slabs:

    a. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
    b. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
    c. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
    d. Do not embed threadless fittings in concrete unless specifically approved by Engineer for each specific location.

11. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
12. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
13. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
14. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
15. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
16. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
17. Surface Pathways:

    a. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
    b. Install surface pathway with a minimum 2-inch radius control at bend points.
    c. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

18. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

    a. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
    b. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
    c. Install with a maximum of two 90-degree bends or equivalent for each length of pathway 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.

19. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, 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 pathway-sealing fittings according to NFPA 70.
20. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

    a. Where conduits pass from warm to cold locations.
    b. Where an underground service pathway enters a building or structure.
    c. Where otherwise required by NFPA 70.

21. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
22. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
23. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
24. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
25. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.04 PROTECTION

A. Protect coatings and finishes of pathways, boxes, and enclosures from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Category 6 twisted pair cable.
2. Twisted pair cable hardware.
3. Cable management system.
4. Identification products.

1.02 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. Jack: Also commonly called an "outlet," it is the fixed, female connector.

H. LAN: Local area network.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.03 COPPER HORIZONTAL CABLING DESCRIPTION

A. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.04 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.05 ACTION SUBMITTALS

A. Product Data:

1. Category 6 twisted pair cable.
2. Twisted pair cable hardware.
3. Cable management system.
4. Identification products.

B. Twisted pair cable testing plan.

C. Field quality-control reports.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
2. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.09 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.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.02 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated:

a. Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.03 CATEGORY 6 TWISTED PAIR CABLE

A. Category 6 Twisted Pair Cable: Four-pair, balanced -twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.

B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Shielded twisted pairs (FTP).

E. Cable Rating: Plenum.

F. Jacket: Blue thermoplastic.

2.04 TWISTED PAIR CABLE HARDWARE

A. Twisted Pair Cable Hardware: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

D. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

2.05 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.01 WIRING METHODS

A. Routing:

1. Install cables in raceways. Conceal raceway and cables, except in unfinished spaces.

a. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF PATHWAYS

A. Comply with Section 270528 "Pathways for Communications Systems."

B. Comply with Section 260529 "Hangers and Supports for Electrical Systems."

C. Drawings indicate general arrangement of pathways and fittings.

3.03 INSTALLATION OF TWISTED PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
4. Terminate all 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 and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. 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.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper 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.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

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.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, 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.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

3.04 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.05 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607-B and NECA/BICSI-607.

D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.06 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: Class 1.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Cable and Wire Identification:

1. Label each cable within 4 inches 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 the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. 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, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

C. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.07 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

C. Nonconforming Work:

1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

D. Collect, assemble, and submit test and inspection reports.

END OF SECTION

SECTION 310000 – EROSION, SEDIMENT, AND POLLUTION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Provide project administration and construction activities to control erosion, sedimentation, and pollution from the Project, according to this section and applicable local, state, and federal requirements.

1.03 DEFINITIONS

A. Alaska Certified Erosion and Sediment Control Lead (AK-CESCL): Certification demonstrating the person has completed training, testing, and other requirements recognized by the Developer to satisfy the ADEC Construction General Permit requirement for "qualified personnel." AK-CESCL certificates issued in conformance with, and under the authority of the AK-CESCL Memorandum of Understanding are recognized by the Developer as meeting this standard.

B. ADEC: Alaska Department of Environmental Conservation.

C. APDES: Alaska Pollutant Discharge Elimination System, administered by ADEC and authorized under the Clean Water Act.

D. Area of Land Disturbance: The area of land (soil) that will be disturbed by a construction activity including, but not limited to, clearing, grubbing, excavating, constructing embankment, grading, stockpiling erodible material, or processing material. Area of pavement removal is not included if the pavement removal work does not remove the aggregate underlying the pavement.

E. Best Management Practices (BMPs): Temporary or permanent structural and non-structural devices, schedules of activities, prohibition of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the United States. BMPs also include, but are not limited to, treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal.

F. Clean Water Act (CWA): United States Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.)

G. Construction Activity: Physical activity by the Contractor or any Subcontractor or Utility Company within the Project that may result in land disturbance. Construction Activity includes, but is not limited to, clearing, grubbing, excavating, constructing embankment, grading, stockpiling erodible material, processing material, and installation or maintenance of BMP's.

H. Construction General Permit (CGP): The APDES General Permit for Discharges from Large and Small Construction Activities, issued by ADEC in compliance with the CWA.

I. NOI: The Notice of Intent submitted to ADEC, to begin Construction Activity under the CGP.

J. NOT: The Notice of Termination submitted to ADEC, to end coverage under the CGP.

K. Erosion and Sediment Control Plan (ESCP): A project-specific narrative developed by the Developer to identify specific information about the Project. The ESCP may include measures to minimize erosion and contain sediment within the Project site. The ESCP narrative provides general information for the Contractor's use in developing the Project SWPPP.

L. Final Stabilization: Soil disturbing activities within an area have been completed and one of the following methods, as identified in the contract, has been completed:

1. Establish a uniform and evenly distributed perennial vegetative cover with a density of 70 percent of the native background vegetative cover, or
2. Construct non-erodible permanent stabilization measures (such as riprap, gabions, geotextiles, pavement, or crushed aggregate base course) where vegetative cover is not required.

M. Haul Route: Existing or newly constructed road where construction materials are transported and where deposition of sediments or erodible materials may result from the material hauling activity or from the Contractors activity to construct or maintain the road.

N. Hazardous Material Control Plan (HMCP): The Contractor's detailed plan for prevention of pollution from storage, use, transfer, containment, cleanup, and disposal of hazardous material, including but not limited to, petroleum products related to construction activities and equipment. The HMCP is included as an appendix to the SWPPP.

O. Joint Inspection: SWPPP inspection performed by the Superintendent, SWPPP Manager, or SWPPP Manager's Representative, and the Engineer of Record. Joint Inspection is performed together, as a collaborative effort of the Contractor and the Developer.

P. Operator: The party associated with a construction project, staging area, material site, material processing site, disposal site, or haul route, with either or both:

1. Operational control of the plans and specifications, including ability to make modification to those plans and specifications.
2. Day-to-day operational control (e.g. authorized to direct workers or equipment operations) of activities related to the project, staging area, haul route, or material or disposal site.

Q. Pollutant: As defined in 40 CFR 122.2 (a partial listing of this definition includes solid waste, sewage, garbage, chemical wastes, dredged spoil, rock or sand).

R. Project: The physical limits of the construction site as shown on the plans. Contractor or Commercial Operator-furnished material sites, material processing sites, disposal sites, haul routes, staging and equipment storage areas are not included in the Project.

S. Spill Prevention, Control and Countermeasure Plan (SPCC): The Contractor's detailed plan for petroleum spill prevention and control measures that meets the requirements of 40 CFR 112.

T. Spill Response Field Representative: The Contractor's representative with authority and responsibility for managing, implementing, and executing the HMCP and SPCC, and for the Contractor's compliance with 40 CFR 112, and other applicable federal, state, and local laws and regulations related to hazardous materials.

U. Storm Water Pollution Prevention Plan (SWPPP): The Contractor's detailed, project-specific plan to minimize erosion and contain sediment within the Project site and to prevent discharge of pollutants that exceed applicable water quality standards. The SWPPP includes, but may not be limited to, amendments, records of activities, inspection schedules and reports, qualifications of key personnel, and all other documentation required by the CGP and this specification.

V. Subcontractor Spill Response Coordinator: The subcontractor's representative with authority and responsibility for coordinating the subcontractor's activities in compliance with HMCP and SPCC.

W. Subcontractor SWPPP Coordinator: The Subcontractor's representative with authority to direct the Subcontractor's work, and who is responsible for coordination with the SWPPP Manager and for the Subcontractor's compliance with the SWPPP.

X. Superintendent: The Contractor's authorized representative in responsible charge of the work, who is duly authorized by the Contractor, in accordance with CGP, Appendix F, Section 1.12. The Superintendent has responsibility and authority for the overall operation of the Project and for Contractor-furnished sites and facilities directly related to the Project.

Y. SWPPP Amendment: A revision or document that adds to, deletes from, or modifies the SWPPP.

Z. SWPPP Manager: The Contractor's qualified representative responsible for CGP compliance, implementing the SWPPP, conducting inspections, updating the SWPPP, supervising work performed under this Specification Section, monitoring construction activities, and with authority to suspend work and implement corrective actions.

AA. SWPPP Manager's Representative: The Contractor's qualified representative who may be assigned certain SWPPP Manager's tasks and authorities.

BB. SWPPP Preparer: The Contractor's qualified representative who is responsible for designing the initial SWPPP.

CC. SWPPP Template: A template is available for the Contractor's use in preparing the SWPPP. The template is found online at ADEC's website. Select "EPA SWPPP Template."

DD. Temporary Stabilization: The protection of exposed soils (disturbed land) from wind and water erosion during the construction process, until final stabilization is established.

1.04 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.05 SUBMITTALS

A. General: Partial and incomplete submittals will not be accepted for review. Any submittal that is re-submitted or revised after submission, but before the review is completed, will restart the submittal review timeline.

B. Hazardous Material Control Plan. Submit one copy of the HMCP as an appendix to the SWPPP, and in accordance with the requirements for submitting the SWPPP.

C. Spill Prevention, Control and Countermeasure Plan:

1. When SPCC is required under Article 3.03, submit one signed copy of the SPCC to the Engineer of Record. Deliver this document to the Engineer of Record at least 14 calendar days before you plan to begin construction activity.
2. The Engineer of Record will keep the SPCC as a record document and reserves the right to review it and require modifications.

D. Storm Water Pollution Prevention Plan:

1. Submit one signed copy of the SWPPP to the Engineer of Record for approval. Deliver this document to the Engineer of Record at least 14 calendar days before you plan to begin Construction Activity. Organize and bind the SWPPP documents for submittal according to the requirements of paragraph 3.01.B.
2. Submit copies of the SWPPP to ADEC and to local governments when required according to CGP, Part 5.13.
3. The Engineer of Record will review the SWPPP submittals within 14 calendar days after they are received. Submittals will be returned to the Contractor and marked as either requiring modification or as approved by the Engineer of Record.

E. ADEC CGP:

1. Obtain construction authorization for the Project under ADEC's CGP. APDES authorization and compliance for Contractor-furnished and commercial operator-furnished areas are the sole responsibility of the Operators.
2. The Contractor and the Engineer of Record must sign and certify the approved SWPPP in accordance with the CGP requirements detailed in Appendix F, before the Contractor submits their NOI for the Project to ADEC. The certification statement cannot be amended or edited.
3. Submit an NOI for the Project to ADEC. Submit one copy of the NOI to the Engineer of Record when the NOI is submitted to ADEC. The Developer will submit the Owner's NOI to ADEC. Allow adequate time for state processing of both NOI's, and for ADEC to list both NOIs as active status, before beginning Construction Activity.

F. Ending CGP Coverage: Within 30 days after the Engineer of Record has determined you may end SWPPP activities for the Project, submit your NOT for the Project to ADEC and send a copy of the NOT to the Engineer of Record. Within 30 days of the Engineer of Record's determination, the Engineer of Record will submit the Owner's NOT to ADEC and will terminate the Developer's CGP coverage for the Project and send a copy to the Contractor.

1.06 PERSONNEL QUALIFICATIONS

A. Include qualifications of the Superintendent, SWPPP Preparer, SWPPP Manager, and SWPPP Manager's Representatives in the SWPPP.

B. The SWPPP Preparer must meet at least one of the following qualifications:

1. Current certification as a Certified Professional in Erosion and Sediment Control (CPESC).

2. Current certification as Alaska Certified Erosion and Sediment Control Lead (AK-CESCL), and at least three years experience in erosion and sediment control (provide documentation including project names, project timelines, and work responsibilities demonstrating the experience requirement).
3. Professional Engineer registered in the State of Alaska.

C. The Superintendent must meet all the following qualifications:

1. Current certification as Alaska Certified Erosion and Sediment Control Lead (AK-CESCL).
2. Duly authorized representative, as defined in the CGP, Appendix A.

D. The SWPPP Manager and SWPPP Manager's Representative must hold current AK-CESCL certification.

1.07 SIGNATURE/CERTIFICATION REQUIREMENTS AND DELEGATIONS

A. NOI and NOT: The NOI and NOT must be signed and certified by a responsible corporate officer, in accordance with CGP Appendix A, Section 1.12. Signature and certification authority for the NOI and NOT cannot be delegated.

B. Delegation of Signature Authority for Other SWPPP Documents and Reports: Delegate signature and certification authority to the Superintendent, in accordance with CGP Appendix A, Section 1.12, for the SWPPP, SWPPP inspections, and other related CGP documents. Include a copy of the written delegation in the SWPPP. Delegation is not required if the Superintendent is a responsible corporate officer for Contractor, as defined in CGP Appendix A, Section 1.12. A sample Delegation of Authority Form can be found in the EPA SWPPP Template.

1.08 OPERATORS

A. The Developer is not an operator for Contractor-furnished:

1. Material sites.
2. Material processing sites.
3. Disposal sites.
4. Haul routes where deposition of erodible materials may result from material hauling activity.
5. Staging areas.
6. Equipment storage areas.

B. The Contractor is an operator for the above-listed Contractor-furnished areas. Compliance with APDES and other applicable federal, state, and local requirements, and securing all necessary clearances, rights, and permits for these Contractor-furnished areas are the sole responsibility of the Contractor. Document the name of each operator and the locations of these areas in the Project SWPPP. The Developer reserves the right to inspect Contractor-furnished areas related to this Contract for compliance with APDES and other applicable federal, state and local requirements.

C. The Developer is not an operator for commercial-operator-furnished:

1. Material sites.
2. Material processing sites.
3. Disposal sites.

4. Haul routes.
5. Staging areas.
6. Equipment storage areas.

D. Compliance with APDES and other applicable federal, state, and local requirements, and securing all necessary clearances, rights, and permits for these commercial operator-furnished areas are the sole responsibility of the commercial operator. Document the name of each operator and the locations of these areas in the Project SWPPP.

1.09 RESPONSIBILITY AND AUTHORITY OF THE SUPERINTENDENT, SWPPP MANAGER, AND SWPPP MANAGER'S REPRESENTATIVE

A. The Superintendent is responsible for the overall operation of the Project and all Contractor-furnished sites and facilities directly related to the Project. The Superintendent shall sign and certify the SWPPP, SWPPP inspection reports, and other SWPP related documents required under the CGP, except the NOI and NOT. The Superintendent may not delegate the task or responsibility of signing and certifying the SWPPP inspection reports, and other related SWPPP documents.

B. The SWPPP Manager is responsible for work related to this section. The SWPPP Manager is responsible for the Contractor's compliance with the CGP, and to assure the Contractor's Construction Activity does not result in discharge of pollutants that exceed applicable water quality standards. The SWPPP Manager is responsible to perform SWPPP inspections, direct or oversee installation, maintenance, and removal of BMPs as detailed in the SWPPP or as directed by the Engineer of Record.

C. The SWPPP Manager may assign the SWPPP Manager's Representative responsibility to perform SWPPP inspections, direct or oversee installation, maintenance, and removal of BMPs as detailed in the SWPPP or as directed by the Engineer of Record. The SWPPP Manager and the SWPPP Manager's Representative shall be knowledgeable in the requirements of this section, the SWPPP, CGP, BMPs, HMCP, SPCC, environmental permits and the environmental commitments. SWPPP inspections must be performed by either the SWPPP Manager or the SWPPP Manager's Representative.

D. The Superintendent, SWPPP Manager, and the SWPPP Manager's Representative shall have the Contractor's complete authority to suspend construction activities that do not conform to the SWPPP or CGP.

E. Coordinate with the Engineer of Record to confirm determinations of CGP noncompliance which may endanger health or the environment. Report CGP noncompliance which may endanger health or the environment to ADEC. Information must be provided orally within 24 hours from the time you become aware of the discharge. Submit written notice as described in Appendix A, Section 2.0 of the CGP.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Comply with the material requirements described in the Specifications.

B. Use materials suitable to withstand hydraulic, wind, and soil forces, and to control erosion and trap sediments in accordance with the requirements of the CGP.

C. Straw must be certified as free of noxious weed by the United States Department of Agriculture, Natural Resources Conservation Service, Local Soil and Water Conservative District, Alaska Weed Free Forage Certification Program. Hay may not be substituted for straw.

D. Temporary seed must consist of annual rye grass or the specified temporary seed mixture.

E. When a rain gauge is required under Article 3.04.D.6, use an Oregon Scientific RGR126 wireless rain gauge with temperature or approved equal.

PART 3 - EXECUTION

3.01 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) REQUIREMENTS

A. Develop the SWPPP and all associated documents, in accordance with the requirements of the CGP.

B. Use the ESCP narrative as a starting point for designing the SWPPP. The approved SWPPP replaces the ESCP. Develop the SWPPP in accordance with EPA's Template.

1. Compile the SWPPP in three-ring binders with tabbed and labeled dividers for each section and appendix included in EPA's Template. Incorporate applicable requirements of the project permits and environmental commitments into the SWPPP. See the ESCP narrative in Appendix B of the Project Specifications for information on consultation with the State Historic Preservation Officer and federal agencies for consideration of historic properties and endangered species. Make additional consultations as necessary for Contractor or commercial operator's specific activities which fall outside the Project limits, or which may result in changes to the Project footprint or timeline.

C. It is preferable that the SWPPP Preparer visit the site before designing the SWPPP. It is required that the SWPPP Preparer visit the site before beginning construction activity. The findings of the visit must be incorporated into the draft SWPPP, or by amending the approved SWPPP, as appropriate. The SWPPP Preparer must visit the site accompanied by a representative of the Contractor and the Developer. Consider opportunities to adjust phasing to minimize potential for erosion. Consider appropriate selection, application, and sequencing of BMPs. Consider sequence of BMP installations in relation to progress schedule. Document the SWPPP Preparer's visit in the SWPPP. Include the date and the names of the personnel participating in the visit.

D. The SWPPP must identify specific areas where potential erosion, sedimentation, or pollution may occur. The potential for wind erosion must be addressed. The potential for erosion at drainage structures must be addressed. Describe site-specific BMPs, source controls, sediment controls, discharge points, and a plan including schedule and implementation procedures for temporary and final stabilization. Describe all temporary and permanent stabilization measures. Include typical installation drawings for all BMPs that will be incorporated in the Project. Include the Contractor's progress schedule, and the schedule for stabilization and installation of other BMPs. Include a listing of equipment to be used for erosion and sediment control activities.

E. The SWPPP must provide erosion and sediment control, in accordance with the CGP and this specification, for all land disturbances resulting from the Contractor and all Subcontractors activities during the course of the contract. The SWPPP must consider the activities of utility companies performing work on the Project. The SWPPP must describe the roles and responsibilities of the Contractor, subcontractors, and the Owner with regard to implementation of the SWPPP. The SWPPP must identify all operators for the Project,

including utility companies performing Construction Activity within the Project, and identify the areas over which each operator has operational control.

F. Designate a Superintendent, SWPPP Manager and SWPPP Manager's Representative and specify the line of authority for each. Provide 24-hour contact information for the Superintendent, SWPPP Manager, and for each SWPPP Manager's Representative. The Superintendent, SWPPP Manager and each SWPPP Manager's Representative must have 24-hour contact information for all Subcontractor SWPPP Coordinators.

G. Identify the SWPPP inspection schedule in the SWPPP.

H. The SWPPP is a dynamic document. Keep the SWPPP current by noting installation, modification, and removal of BMPs, and by using amendments, SWPPP amendment logs, inspection reports, corrective action logs, records of land disturbance and stabilization, and any other documents necessary to satisfy the requirements of the CGP and this specification.

3.02 HAZARDOUS MATERIAL CONTROL PLAN (HMCP) REQUIREMENTS

A. Prepare the HMCP for prevention of pollution from storage, use, containment, cleanup, and disposal of all hazardous material, including petroleum products related to construction activities and equipment (see 40 CFR 117 and 302 for listing of hazardous materials).

B. Compile Material Safety Data Sheets in one location and reference that location in the HMCP.

C. List and give the location and estimated quantities of hazardous materials to be used or stored on the Project. Store hazardous materials in covered storage areas. Include secondary containment for all hazardous material storage areas.

D. List the types and approximate quantities of response equipment and cleanup materials available on the Project. Include a list and location map of cleanup materials, at each different work site and readily available off site (materials sources, material processing sites, disposal sites, staging areas, etc).

E. Designate a Spill Response Field Representative and identify the line of authority. Designate a Subcontractor Spill Response Coordinator. Provide 24-hour contact information for the Contractor's Spill Response Field Representative.

F. The Contractor's Spill Response Field Representative must have 24-hour contact information for the Subcontractor Spill Response Coordinator.

G. Identify the locations where storage, fueling and maintenance activities will take place, describe the maintenance activities, and list controls to prevent the accidental spillage of oil, petroleum products, and other hazardous materials.

H. Detail procedures for containment and cleanup of hazardous substances. Detail a plan for the prevention, containment, cleanup, and disposal of soil and water contaminated by spills. Detail a plan for dealing with contaminated soil and water encountered during construction.

I. Detail methods of disposing of waste petroleum products and other hazardous materials generated by the Project. Identify haul methods and final disposal areas. Assure final disposal areas are permitted for hazardous material disposal.

J. Store spill response materials, appropriate to the hazards associated with that site, in sufficient quantity at each identified location.

K. Include the HMCP as an appendix to the SWPPP.

3.03 SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN (SPCC) REQUIREMENTS

A. Prepare and implement an SPCC when required by 40 CFR 112; when both of the following conditions are present on the Project:

1. Oil or petroleum products from a spill may reach navigable waters.
2. Total above ground storage capacity for oil and any petroleum products is greater than 1,320 gallons (not including onboard tanks for fuel or hydraulic fluid used primarily to power the movement of a motor vehicle or ancillary onboard oil-filled operational equipment, and not including containers with a storage capacity of less than 55 gallons).

B. Reference the SPCC in the SWPPP.

3.04 CONSTRUCTION REQUIREMENTS

A. Comply with the SWPPP and the requirements of the CGP.

B. Ensure all subcontractors and utility companies operating within the Project understand and comply with the SWPPP and the CGP.

C. Train employees and subcontractors as necessary to make them aware of the BMPs and storm water protection procedures at the site.

D. Starting Construction:

1. Do not begin Construction Activity until the SWPPP has been approved by the Engineer of Record.
2. Do not begin Construction Activity until authorized by the Developer's Representative.
3. Do not begin Construction Activity until the Project NOI for the Developer and for the Contractor are both listed as Active Status on the ADEC website.
4. Do not begin Construction Activity until the SWPPP preparer has visited the Project and the date of the visit and the persons conducting the visit have been documented in the SWPPP and the SWPPP has been developed or amended based on the findings of the visit.
5. Post notices on the outside wall of the Contractor's project office, and at publicly accessible locations near the beginning and end of the Project. Protect postings from the weather and locate so the public can read them without obstructing construction activities (for example, at an existing pullout). Include the following information in each of the posted notices:

    a. Copy of all NOIs related to this project.
    b. Name and phone number of SWPPP Manager.
    c. Location of the SWPPP available for public viewing.

6. If the project is not within 20 miles of a National Weather Service gauge, install an outdoor rain gauge in an approved and readily accessible location on the Project.
7. Install sediment controls in accordance with the SWPPP and SWPPP sequencing and phasing, and before beginning Construction Activity.

E. During Construction:

1. Comply with requirements of the HMCP and SPCC, and all state and federal regulations that pertain to the handling, storage, cleanup, and disposal of petroleum products or other

hazardous substances. Contain, clean up, and dispose of discharges of petroleum products and other hazardous materials. Place absorbent pads or other suitable containment under fill ports while fueling and under equipment during maintenance or repairs. Install secondary containment under all stationary equipment that contains petroleum products.

2. Comply with the requirements of 18 AAC 75 and AS 46, Oil and Hazardous Substances Pollution Control. Report petroleum product spills as required by federal, state and local law, and as described in the HMCP and SPCC.
3. Comply with the requirements of the SWPPP. Implement temporary and permanent erosion and sediment control measures identified in the SWPPP. Keep the SWPPP current. If storm water discharges threaten water quality, take immediate action. Comply with the requirements of 18 AAC 70 State of Alaska Water Quality Standards, AS 16.05.841 and 16.05.871 Protection of Fish and Game, 11 AAC 112 Alaska Coastal Management Program, Section 404 of the CWA, and all other applicable federal, state, and local statutes and regulations.
4. Coordinate with subcontractors and utility companies doing work in the project area so BMPs, and temporary and permanent stabilization are installed, maintained, and protected from damage.

F. Corrective Action and Maintenance of BMPs:

1. Maintain temporary and permanent erosion and sediment control measures in effective operating condition. Remove sediment and debris from sediment traps, silt fences, and sediment ponds before sediment or debris accumulates to 50 percent of the BMP's design capacity.
2. Implement corrective action:

    a. If an incident of non-compliance with the SWPPP or CGP is identified.
    b. If an inspection identifies the SWPPP or any part of the SWPPP is ineffective in preventing the discharge of pollutants that exceed applicable water quality standards.
    c. If the Engineer of Record determines the SWPPP or any part of the SWPPP is ineffective in preventing the discharge of pollutants that exceed applicable water quality standards.
    d. If any BMP is damaged, undercut, or unable to effectively perform the intended function.
    e. If any BMP is at or exceeding 50 percent of its design storage capacity.
    f. Whenever there is a change in conditions, design, construction, operation, or maintenance that could affect the discharge of pollutants in storm water leaving the Project.

3. Implement corrective actions as soon as possible, and before the next storm event whenever practicable. If implementation before the next storm event is impracticable, the situation must be documented in the SWPPP and alternative BMPs must be implemented as soon as possible.

G. Stabilization:

1. Stabilization may be accomplished using temporary or permanent measures. Initiate stabilization of disturbed areas, stockpiles, and of erodible aggregate layers so that all of the following conditions are satisfied:

    a. As soon as practicable.

b. As soon as necessary to avoid discharge of pollutants that exceeds applicable water quality standards.
c. As identified in the SWPPP schedule and/or phasing.
d. In accordance with stabilization schedule requirements of applicable project permits.
e. No later than 3 days in areas adjacent to stream as shown on the plans and 14 days after each cessation of land-disturbing activities in other areas.

2. Land may be disturbed multiple times during a project. Coordinate work to minimize area of land disturbance as much as practicable. Do not disturb more area than you can stabilize in the time limits specified, and with the resources available.
3. Temporary stabilization measures may include individual or a combination of measures including but not limited to vegetative cover, mulch, stabilizing emulsions, blankets, mats, soil binders, non-erodible cover, dust palliatives, or other approved methods.
4. Apply temporary seeding uniformly at a usual rate of 1/2 pound per 1,000 square feet, but up to a maximum rate of 1-1/2 pounds per 1,000 square feet on steep slopes or highly erodible soils. Prepare the surface to be seeded to reduce erosion potential and to facilitate germination and growth of vegetative cover. Maintain seeded areas. Reseed areas where growth of temporary vegetative cover is inadequate to stabilize disturbed ground.
5. Apply permanent seed in accordance with Division 32 Section “Turf and Grasses” at locations where permanent seed is indicated on the plans and land-disturbing activity is permanently ceased.
6. When installing a culvert or other drainage structure where stream bypass is not used for construction, temporary or permanent stabilization may need to be installed concurrently or immediately after placing the culvert or drainage structure in order to comply with applicable project permits and to prevent discharge of pollutants that exceed applicable water quality standards. Install temporary or permanent stabilization:

   a. At the culvert or drainage structure inlet and outlet.
   b. In the area upstream and downstream of the culvert or drainage structure, that is disturbed in the process of installing the culvert, culvert end walls, culvert end sections, or drainage structure.

7. Prevent project contaminates from entering all bodies of water (flowing and not flowing) on and off the project site, during all phases of construction (from “the effective date of the Notice to Proceed” to the issue of the “Letter of Final Acceptance”) in conformance with the project requirements. Maintain project water quality as specified in the Plans and Specifications (including Special Provisions), including, but not limited to, construction/installation of drainage structures providing erosion, sediment and pollution control measures, including stabilization, at the drainage structure inlet and outlet and up/downstream from the structure.

H. Ending SWPPP Activities and SWPPP Maintenance:

1. The Engineer of Record will determine SWPPP activities have ended when all of the following requirements are met:

   a. Land disturbing activities have ceased.
   b. The Project site has achieved final stabilization.
   c. Temporary BMPs have been removed.

2. Submit NOT in accordance with paragraph 1.03.F.

I. Record Retention:

1. Transmit one copy of the final SWPPP, including all amendments and appendixes, to the Engineer of Record when the NOT's are filed.
2. Retain copies of the SWPPP, including documents listed under Article 3.05, SWPPP Documents, for at least three years after the date of NOT. If ADEC inspects the project, issues a Notice of Violation (NOV), or begins investigation for a potential NOV before the three-year retention period expires, retain the SWPPP and all records related to the SWPPP and CGP until ADEC has determined all issues related to the investigation are settled.

3.05 SWPPP DOCUMENTS

A. Keep the approved SWPPP, HMCP, and SPCC at the on-site project office. If there is no on-site project office, keep the information in an office that is within 30 miles, by road, from the Project at a location suitable to the Developer.

B. Maintain all SWPPP documents in binders in one common location. Include the following items in the SWPPP binders:

1. NOI's (all applicable).
2. Signature Delegation.
3. Qualification Documentation of Key Personnel.
4. Approved SWPPP.
5. SWPPP Certification.
6. HMCP.
7. SPCC (when required).
8. SWPPP Amendments.
9. SWPPP Amendment Log.
10. SWPPP Inspection Reports.
11. SWPPP Corrective Action Log.
12. SWPPP Grading and Stabilization Activities Log.
13. SWPPP Daily Record of Rainfall Log.
14. Lines of authority and contact information for Superintendent, SWPPP Manager, SWPPP Manager's Representative and Subcontractor SWPPP Coordinators.
15. NOT's (all applicable).
16. Any other records related to the SWPPP, SWPPP compliance, or CGP reporting requirements.

C. The SWPPP and related documents maintained by the Contractor are the record documents for demonstrating compliance with the CGP. SWPPP documents transmitted to the Engineer of Record and/or the Developer under the requirements of this specification are informational and do not relieve the Contractor from responsibility to maintain complete records as required by the CGP and this specification.

3.06 SWPPP INSPECTIONS, AMENDMENTS, REPORTS, AND LOGS

A. Perform inspections, prepare inspection reports, and prepare SWPPP amendments in compliance with the SWPPP and the CGP. Prepare SWPPP Corrective Action Log, SWPPP Amendment Log, SWPPP Grading and Stabilization Logs, and SWPPP Daily Record of Rainfall forms. SWPPP joint inspections must be performed by the Superitendent, SWPPP Manager, or the SWPPP Manager's Representative and the Engineer of Record.

B. Before Starting Construction: Before beginning Construction Activity, conduct a Joint Inspection of the Project. Include the SWPPP Preparer in the inspection and consider any necessary revisions to the draft SWPPP, or if the SWPPP has already been approved, any necessary amendments to the SWPPP. Consider opportunities to adjust phasing to minimize potential for erosion. Consider appropriate selection, application, and sequencing of BMPs. Consider sequence of BMP installations in relation to progress schedule. Identify sediment controls that need to be installed prior to commencing other Construction Activity.

C. During Construction:

1. Conduct Joint Inspections on one of the following schedules:

   a. At least once every seven days during construction.
   b. At least once every 14 days during construction and within 24 hours of the end of a storm event that results in a discharge from the site.

2. Indicate the inspection schedule in the SWPPP and conduct Joint Inspections in accordance with the selected schedule.

D. Before Seasonal Suspension of Work: Conduct Joint Inspection before seasonal suspension of work to review condition and applicability of BMPs and SWPPP. Confirm SWPPP, temporary stabilization, and BMPs are installed and functioning in accordance with the requirements of Article 3.4, Construction Requirements.

E. During Seasonal Suspension of Work:

1. Conduct Joint Inspections in accordance with the inspection schedule indicated in the approved SWPPP. Inspection frequency during seasonal suspension of work may be reduced to at least one inspection every month if approved by the Engineer of Record and the revised inspection frequency is documented as an amendment to the SWPPP, and either of the following requirements is met:

   a. The entire site is temporarily stabilized.
   b. Runoff is unlikely due to winter conditions (e.g., the site is covered with snow or ice or the ground is frozen).

2. The Engineer of Record may waive winter monthly inspection requirements until one month before thawing conditions are expected to result in a discharge, if all of the following requirements are met:

   a. Below-freezing conditions are anticipated to continue for more than one month.
   b. Land disturbance activities have been suspended.
   c. Beginning and ending dates of the waiver period are documented as an amendment to the SWPPP.

3. The Engineer of Record may waive requirements for updating the Grading and Stabilization Activities Log and Daily Record of Rainfall form during seasonal suspension of work. Resume collecting and recording weather data on the Daily Record of Rainfall form one month before thawing conditions are expected to result in a discharge. Resume recording land disturbance and stabilization activities on the Grading Activities Log when Construction Activity resumes.

F. During Winter Work: Conduct Joint Inspections in accordance with the inspection schedule indicated in the approved SWPPP. Inspection frequency during winter work may be reduced to at least one inspection every month if all of the following requirements are met:

1. Runoff is unlikely due to winter conditions (e.g., the site is covered with snow or ice or the ground is frozen).
2. Approval is obtained from the Engineer of Record.
3. The revised inspection frequency is documented as an amendment to the SWPPP.

G. Project Completion: Conduct Joint Inspection to ensure final stabilization is complete throughout the Project and all temporary BMPs are removed.

H. Items and Areas to Inspect:

1. Inspect all items and areas covered under both the Developer's and the Contractor's Project NOI's and included in the SWPPP.
2. When included in the SWPPP, inspect the following:

    a. Disturbed areas that have not been finally stabilized.
    b. Areas used for storage of erodible materials that are exposed to precipitation.
    c. BMPs.
    d. Perimeter sediment control and discharge locations.
    e. Staging and equipment storage areas.

3. Petroleum storage, handling and fueling sites.

    a. Hazardous material storage sites.
    b. Locations where vehicles or construction equipment enter or exit Project.
    c. Material sources and disposal sites.
    d. Discharge locations.

4. Areas referenced in the Project SWPPP that are Contractor-furnished, or commercially furnished, and the Developer is not an operator, do not require Joint Inspection in accordance with this contract. For Contractor or commercial operator-furnished areas, the Contractor or commercial operator is solely responsible for inspecting and assuring compliance with all APDES requirements, and any other federal, state, local, or tribal permitting requirements.

I. Inspection Reports:

1. Inspection Report Form shall contain the following information:

    a. Inspection date, general information, type of inspection.
    b. Names, titles and qualifications of personnel inspecting.
    c. Weather information for the period since the last inspection, including storm events and any discharges that occurred during this period.
    d. Current weather information and a description of any discharges currently occurring.
    e. Location of discharges of sediment or other pollutants from the site.
    f. Locations of BMPs where maintenance is necessary.
    g. Locations of BMPs that failed to operate as designed or proved inadequate for a particular location.
    h. Locations where additional BMPs are needed that did not exist at the time of inspection.

i. Corrective action required including any changes to the SWPPP necessary and implementation dates.
j. Overall site issues.
k. Whether construction site is in compliance with SWPPP and the CGP.
l. Signatures and certifications by the SWPPP Superintendent and Owner's Representative.

2. Submit an inspection form containing the above information to the Engineer of Record for approval as required in paragraph 1.03.D, Submittals.
3. Complete all fields included on the inspection form.
4. The Superintendent must sign and certify the inspection report on the day of the inspection, and must provide the report to the Engineer of Record the same day. The Engineer of Record will sign and certify the inspection report and will return the original to the Contractor within three working days.

J. SWPPP Amendments and the SWPPP Amendment Log:

1. The Superintendent, SWPPP Manager, or SWPPP Manager's Representative are responsible for amending the SWPPP and shall initial all amendments to the SWPPP:

a. Whenever there is a change in design, construction operation, or maintenance at the construction site that has or could have significant effect on the discharge of pollutants that has not been previously addressed in the SWPPP.
b. If a Joint Inspection identifies the SWPPP or any portion of the SWPPP is ineffective in preventing the discharge of pollutants from the Project that exceed applicable water quality standards.
c. If the Engineer of Record or Contractor determines the SWPPP or any portion of the SWPPP is ineffective in preventing the discharge of pollutants from the Project that exceed applicable water quality standards.
d. Whenever an inspection identifies a problem that requires additional or modified BMPs.

2. Amend the SWPPP narrative as soon as practicable after any change or modification, but in no case later than seven (7) calendar days following an inspection. Include the following information when documenting modifications to the SWPPP:

a. Date the action was completed.
b. Initials of person documenting the action.
c. Description of the action.

3. Update the SWPPP drawings including date, location, action taken, and initials of the person recording the action for:

a. Installation of BMP.
b. Modification of BMP (including any changes to BMP typical installation details).
c. Removal of BMP.

4. Give draft SWPPP Amendments to the Engineer of Record for review and approval.
5. Use the EPA's SWPPP Template's Appendix G, SWPPP Amendment Log Form, to track all amendments to the SWPPP. The Superintendent, SWPPP Manager or SWPPP Manager's Representative shall initial all entries on this Form. Keep the SWPPP Amendment Log current and submit a copy to the Engineer of Record, including copies

of any documents amending the SWPPP, prior to performing each scheduled SWPPP inspection.

6. Include the current SWPPP Amendment Log as an appendix to the SWPPP.

K. Corrective Action:

1. Action required to restore effective function of BMP's or the SWPPP is corrective action and must be documented. Use the EPA's SWPPP Template's Appendix F, Corrective Action Log Form, to document corrective actions to the SWPPP and to BMPs. The Superintendent, SWPPP Manager, or SWPPP Manager's Representative shall initial all entries on this Form.
2. After each inspection report has been signed and certified, update the corrective action log to include all corrective actions noted on the inspection report.
3. After the corrective action has been accomplished, note the action taken and date and initial the entry.
4. Keep the corrective action log current and submit a copy to the Engineer of Record prior to performing each scheduled SWPPP inspection.
5. Keep the corrective action log as an appendix to the SWPPP.

L. Grading and Stabilization:

1. Use the EPA's SWPPP Template's Appendix I, Grading and Stabilization Activities Log Form, to record land disturbance and stabilization activities. The Superintendent, SWPPP Manager or SWPPP Manager's Representative shall initial all entries on this Form. Keep the grading and stabilization activities log current and submit a copy to the Engineer of Record prior to performing each scheduled SWPPP inspection.
2. Keep the grading and stabilization activities log as an appendix to the SWPPP.

M. Daily Weather Records: Create a SWPPP Daily Record of Rainfall Form, to record weather conditions at the Project. The form shall have three columns, with the headers "Date," "Precipitation in Inches," and "Comments." Update the form daily, include the initials of the person recording each day's entry and submit a copy to the Engineer of Record prior to performing each scheduled SWPPP inspection. Include the daily record of rainfall form as an appendix to the SWPPP.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASURMENT

A. Temporary Erosion and Pollution Control will not be measured since it is a lump sum item.

4.02 BASIS OF PAYMENT

A. The lump sum price shall include administration of a SWPPP and HCMP and installation and maintenance of all temporary erosion, sedimentation, and pollution control measures under the original approved SWPPP and HMCP and required amendments.

B. Temporary erosion and pollution control measures that are required at material sources, staging areas, or other Contractor-furnished sites are subsidiary.

C. Contractor shall perform temporary erosion and pollution control measures that are required due to Contractor's negligence, carelessness, or failure to install permanent controls as a part

of the work as scheduled or ordered by the Engineer, or for Contractor's convenience, at his own expense.

D. Permanent erosion and pollution control measures will be measured and paid for under other contract items, when shown on the bid schedule.

Pay Item Number	Pay Item	Pay Unit
310000-1	Temporary Erosion and Pollution Control	Lump Sum

END OF SECTION

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EROSION AND SEDIMENT CONTROL PLAN

1.0 General

The total ground disturbing activities for this project affect more than 1 acre; therefore, authorization to conduct construction activities under the State of Alaska Department of Environmental Conservation (ADEC) Alaska Pollutant Discharge Elimination System (APDES) Construction General Permit (CGP) must be obtained. The ADEC CGP 2016 Permit can be found on ADEC's website, https://dec.alaska.gov/water/wastewater/stormwater/construction.

This Erosion and Sediment Control Plan (ESCP) narrative was developed based on general knowledge of construction sequencing, available materials, site-specific hydrology, and other relevant factors. It contains information about the construction site that the Contractor may use in developing the Storm Water Pollution Prevention Plan (SWPPP) as required by Section 310000, Erosion, Sediment, and Pollution Control. Further information is available at the above ADEC website and in the *Alaska Storm Water Pollution Prevention Guide* published by the Alaska Department of Transportation and Public Facilities (ADOT&PF) and available on their website at http://www.dot.state.ak.us/. Additionally, the U.S. Environmental Protection Agency (EPA) website http://cfpub.epa.gov/npdes/stormwater/swppp.cfm provides information and guidance including SWPPP templates, sample inspection forms, and other resource information.

Building upon the ESCP narrative, the Contractor's fully developed SWPPP shall provide a more comprehensive and more detailed plan for erosion, sediment, and pollutant control. The SWPPP shall provide details for erosion control and sediment management "systems." Providing for "perimeter control" without also providing for erosion control is not acceptable. Without fully developed pollutant control management "systems," the Draft SWPPP will be rejected.

2.0 Project Description

The work generally consists of, but is not limited to, construction of: extension of the water system to the airport of the City and Borough of Yakutat (CBY) that serves the Yakutat Lodge and Restaurant as a primary goal while also planning for future development along the route and fire flow as a secondary goal.

2.1 Site Description

The majority of the project site is within the existing street right-of-ways. Public utility easements will be utilized as well. The service lines will be installed on the respective private property.

2.2 Scope of Construction

Generally, the project consists of the following work:

- Installation of approximately 4 miles of 6-inch and 10-inch distribution main. The pipe material will be HDPE and Ductile Iron.
- Installation of 31 fire hydrants.
- Installation of 16 water services.
- Asphalt replacement.
- Culvert replacement.
- Seeding.

2.3 Anticipated Sequence of Activities

The Contractor shall modify the following sequence as required to accurately reflect the Contractor's means and methods. Erosion, sediment, and pollutant control activities should be listed and woven into the scheduled sequence of activities. They should be tied to and precede all grading/earth disturbing

activities. This shall include all haul road and staging area development, use, and management for the life of the project. The final sequence of work will be developed by the Contractor and presented in his SWPPP. Final sequencing is dependent on multiple factors including the Contractor's means and methods, logistics, weather, and timing.

- Initiate erosion and sediment controls, to include:
  - Mark project limits and environmental permit boundaries
  - Install perimeter controls
  - Use other controls as appropriate based on Contractor's phasing plan
- Excavate and place water main and fire hydrants.
- Backfill and grade ground surface
- Seed as soon as possible after construction
- Remove all temporary erosion and sediment controls unless specifically allowed to remain by approval of the Owner's Representative

2.4 Area of Ground Disturbance

Construction is expected to take place from May 2026 through November 2027 depending upon conditions. The temporary impacts will depend on the Contractor's methods and means.

The total area estimated to be disturbed is 17 acres. No change in the amount of impervious area is required.

2.6 Receiving Waters

Receiving waters include Ophir Creek, various wetlands and other tributaries which flow to Monti Bay and the Gulf of Alaska.

2.7 Environmental Considerations

The information provided below is for the Contractor's reference. The Contractor is responsible for verifying the information is still valid as part of the SWPPP preparation.

Bird Window

In Southeast Alaska, the USFWS-recommended period to avoid vegetation clearing to protect migratory bird nests is April 15th through July 15th. In addition, the period at which bald eagles may be sensitive to disturbance is March 1 – August 31. While much of the water line will be constructed adjacent to existing roads in developed areas with only grass vegetation, there are some sections of the alignment where the project will cross undeveloped forest. Tree and shrub clearing for the project will occur outside of the migratory bird nesting window, where practicable. In addition, the project will refer to the USFWS's Bald Eagle Management Guidelines which advise on the provisions of the Bald and Golden Eagle Protection Act and actions to minimize impacts to bald eagles.

Threatened or Endangered Species

No threatened or endangered species occur in the project area.

Historical, Archeological, and Cultural Properties

The State Historical Preservation Office (SHPO) provided a determination of No Historic Properties Affected for the initial water line alignment in February 2024. The project design has since changed and includes additional length of water line and a water storage tank and pumphouse. SHPO review has been initiated for the final project design.

3.0 Controls and Protection

This section of the plan addresses the various controls that may be implemented for major construction activities. Major construction activities are expected from June to October. As required under

Section 310000 of the specifications, the Contractor's SWPPP must address the following erosion and sedimentation issues. The Contractor shall include revisions and or additions to this ESCP in the SWPPP.

3.1 Permanent Controls

Permanent erosion and sediment control methods are listed below. Permanent controls are to remain after project completion.

Erosion Control

- Seeding of disturbed areas as soon as possible after reconstruction of the embankments to help reestablish the vegetation, reduce the volume and velocity of runoff, and control the erosive action of storm runoff*
- Seeding with native seeds and surface roughening*
- Preservation of vegetation

Sediment Control

- Use of vegetative buffer strips

*Note: Slope re-vegetation measures (seeding, surface roughening, and mulch) are not permanent until the vegetation reaches a uniform cover with a density of 70 percent.

3.2 Temporary Controls

Temporary controls shall be the responsibility of the Contractor.

The Contractor's first priorities for erosion and sediment control are staging the project to integrate the controls and construction schedule, retaining as much of the natural vegetation for as long as possible, and routing storm water around the work areas so that construction sediment is not incorporated into surface water flow. Areas of particular concern include the fill slopes, the drainage ditches, and the construction areas adjacent to surface water bodies.

Temporary erosion and sediment controls shall conform to Best Management Practices (BMP) and may include one or more of the following:

Erosion Control

- Check dam
- Construction phasing
- Controlled vehicle speeds on haul routes and at the material and construction sites
- Dust control
- Fiber-filled tubes
- Vegetative buffer strips
- Matting or bonded fiber matrix
- Preservation of existing vegetation for as long as possible
- Vehicle tracking exits
- Temporary diversion of water entering construction area
- Track walking
- Geotextiles
- Mulching
- Rolled erosion control products (RECP)
- Seeding with native seeds
- Shoulder berms
- Slope drains

Sediment Control

- Brush bundles
- Check dam
- Interception/diversion berm
- Sediment trap/pond
- Silt fencing or fiber-filled tubes
- Vegetative buffer strips
- Cover for stockpiles or waste piles
- Velocity dissipation at culvert and ditch outfalls
- Inlet protection at culverts

Velocity Control

- Velocity dissipation at culvert and ditch outfalls
- Rock check dams
- Interception/diversion berm

Other

- Watering for dust control
- Correct any problems occurring due to inadequate protection measures
- Other measures as shown or described in the *Alaska Storm Water Pollution Prevention Plan Guide* published by the ADOT&PF or functional equivalent authorized by the Owner's Representative

The temporary and permanent methods are described in more detail in the *Alaska Storm Water Pollution Prevention Plan Guide* (January 2005). Controls must be installed and maintained per the manufacturers' specifications or an equivalent approved by the Engineer of Record. The installation of these devices may be subject to Section 404 of the Clean Water Act.

Water may be diverted around the work area with diversion berms of fiber-filled tube, brush, overburden, or functional equivalent as approved by the Engineer of Record.

Perimeter controls shall also be implemented where necessary to contain construction materials and sediment. Perimeter controls may include silt fencing, fiber-filled tubes, brush berms, vegetative buffer strips or a functional equivalent.

Stabilization measures shall be initiated as soon as practicable, but no later than 14 days (per the CGP), on all portions of the site where construction activities have temporarily or permanently ceased. Temporary controls may be left in place as permanent controls with the authorization of the Engineer of Record. Stockpiles of soil must be stabilized and protected from water and wind erosion. The Contractor is required to cover the stockpiles with plastic, use perimeter controls at the base, initiate seeding, and use other functional equivalents as approved by the Engineer of Record.

The Contractor shall minimize slope steepness and length whenever possible. Berms or fiber-filled tubes (installed as the project progresses) may be placed at the tops of slopes to prevent water from flowing onto the slopes. Additionally, the Contractor may roughen slopes using methods such as track walking to minimize erosion. Other appropriate methods approved by the Engineer of Record may also be used.

Access to the construction site will be limited and controlled. Vehicle tracking exits shall be constructed to remove sediment accumulated on vehicles during construction.

Per the ADEC's Construction General Permit (CGP), Part 4.3.8, temporary sediment control basins, traps, or equivalent control measures must be provided where attainable until final stabilization of the site.

All practices selected for implementation should be determined on the basis of the technical guidance on ADEC's website.

3.3 Other Controls and Potential Sources of Pollution

Solid Waste
All project solid waste shall be properly disposed of and in accordance with Specification Section 311000, "Site Clearing." No solid materials shall be discharged into waters of the U.S. except as authorized by a USACE Section 404 Permit. Solid waste may include, but is not limited to, concrete, wood, steel, old culverts, pipes, etc.

Concrete Washout
The Contractor is required to use controls to minimize the potential for storm water pollutants from washout areas for concrete mixers, paint, stucco, etc. If the Contractor uses any concrete on the project site, there must be an established and signed concrete washout area and a plan for washout waste disposal. Concrete washout facilities must be sited and maintained to prevent runoff. The Contractor will be responsible for the proper disposal of the washout waste. This may include evaporating the water or mixing it with sand and disposing of it as solid waste to a permitted facility. The washout cannot be disposed of on-site or in a material site, and disposal may require backhaul or for the Contractor to obtain a solid waste disposal permit.

Compliance with Regulations
The provisions of this plan shall ensure and demonstrate compliance with applicable State and/or local waste disposal, sanitary sewer, or septic system regulations.

HMCP
The Contractor shall develop and follow a Hazardous Materials Control Plan (HMCP) appropriate to the project location and include this in the SWPPP.

Staging or Stockpile Area
If not already covered in the ESCP, the SWPPP shall include additional erosion control measures to cover these areas.

Wetlands
Wetland boundaries are marked on the ESCP sheets. Fill within these wetlands is allowed only where permitted. A copy of the permit is included in Supplementary Conditions.

Maintenance
The Contractor shall maintain all temporary erosion and sediment controls and remove them once permanent controls are established. Maintenance of the seeded areas includes inspection, watering, and fertilizer application to promote growth. The reconstructed areas, slopes, and embankments must also be maintained to reduce erosion issues.

Vehicle Tracking Exits
When highly erodible soils are exposed and being worked on the project site, stabilized exits will be required to comply with the permit. If there is no need for these stabilized exits, the reasons must also be addressed in the SWPPP.

3.4 Permits and Other Agreements
The Contractor shall read and comply with all permit requirements prior to starting construction and shall submit to the Engineer of Record all plans and specifications required to be submitted to the permitting agency by the permittee.

3.5 Contractor's Areas of Responsibility

The Contractor shall be responsible for the twelve elements of the SWPPP, which are:

a. Mark clearing limits
b. Establish construction access
c. Control flow rates
d. Install sediment controls
e. Stabilize soils
f. Protect slopes
g. Protect drain inlets
h. Stabilize channels and outlets
i. Control pollutants
j. Control de-watering
k. Maintain BMPs
l. Manage the project

Inspections

The Contractor shall inspect and maintain all BMPs and areas of exposed soils. He shall conduct joint inspections with the Engineer of Record per Specification Section 310000.

Record Keeping

While following procedures used to maintain, in good and effective operating conditions, vegetation, erosion and sediment control measures, and other protective measures identified in this plan, the Contractor shall keep thorough records of monitoring, inspecting, evaluations, maintenance, and changes to the SWPPP, BMPs, and drawings. The records shall include:

- Inspection Reports
- SWPPP Amendments and the SWPPP Amendment Log
- Corrective Action
- Grading and Stabilization
- Daily Weather Records

Non-Storm-Water Discharges

Groundwater within the project area east of Moose Creek is considered contaminated and cannot be used for dust control or compaction. See Specification 312319 for Dewatering requirements.

END OF ESCP

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Clearing and grubbing.
3. Removing above- and below-grade site improvements.
4. Protection of existing structures to remain
5. Disconnecting, capping or sealing, and removing site utilities or abandoning site utilities in place.
6. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, traffic control plans, security and protection facilities, and temporary erosion- and sedimentation-control measures.

1.03 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled, temporarily relocated, or otherwise to remain Owner’s property, cleared materials shall become the Contractor's property and shall be removed from the Project site before final acceptance.

1.05 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
3. Include work plan to protect existing structures designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 DUST AND DEBRIS CONTROL

A. Prevent the spread of all dust and debris to adjacent taxiways, roads, and land areas.

B. Avoid the creation of nuisance or hazard in the surrounding area and adjacent property.

C. Do not use water if it will result in or create hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution of adjacent property, taxiways, or streets.

D. Vacuum adjacent existing pavements as often as necessary to control the spread of dust and debris.

1.07 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining taxiways, roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations. See Division 01 Section "Temporary Facilities and Controls" for traffic control plans.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from CBY and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining property will be obtained by Developer before award of Contract.

1. Do not proceed with work on adjoining property until directed by Developer’s Representative.

C. Utility Locator Service: Notify the Alaska Dig Line for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

H. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

I. Do not clearing or grub during the migratory bird window, April 15-July 15, unless:

1. The area has been previously and sufficiently altered to provide no nesting habitat; or
2. The area has been surveyed by a qualified bird expert to determine if there are existing bird nests. If nests are present, do not clear or grub until after the nesting season is completed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to CBY.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction. SEE SECTION 310000 EROSION, SEDIMENT, AND POLLUTION CONTROL.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 EXISTING UTILITIES

A. Locate, identify, and disconnect utilities indicated to be abandoned in place.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by CBY or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Developer and CBY not less than four days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without CBY's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.04 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.05 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.06 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off CBY's property.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Clearing and grubbing will not be measured since it is a lump sum item.

4.02 BASIS OF PAYMENT

A. Payment for clearing and grubbing by the Contractor as specified shall include furnishing all necessary material, personnel, equipment, transportation, and supplies to perform all clearing and grubbing work as shown and specified, including the legal disposal of all debris.

Pay Item Number	Pay Item	Pay Unit
311000-1	Clearing and Grubbing	Lump Sum

END OF SECTION

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SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. U.S. Fish and Wildlife Service (USFWS) Region 7 Guidelines for Preventing the Spread of Aquatic Invasive Species.

C. Alaska Department of Environmental Conservation Division of Spill Prevention and Response. Managing Petroleum-Contaminated Soil, Water, or Free Product during Public Utility and Right-of-Way Construction and Maintenance Projects. Technical Memorandum. September 2018

1.02 SUMMARY

A. Section Includes:
1. Preparing subgrades for slabs-on-grade, walks, pavements, and grasses.
2. Subbase course for pavements.
3. Subbase course and base course for asphalt paving.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.
6. Handling of contaminated soil in trenches.

B. Related Sections:
1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Division 22 Sections for installing underground utilities.
3. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Division 32 Section "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.03 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Material in which utility pipelines or utility-related structures are set.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Breakup: Initiation of spring thaw as defined in APDES General Permit AKR100000 for Discharges from Large and Small Construction Activities (Construction General Permit).

F. Clean Soil: Soil not located below groundwater seasonal fluctuation level and therefore believed to be free of PFAS contamination.

G. Contaminated Soil: All soil below the upper limits of the seasonal groundwater table fluctuation are considered contaminated. Estimated upper limit is shown on project profile sheets.

H. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as recommended by Engineer of Record and approved by Developer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without recommendation by Engineer of Record and approval by Developer. Unauthorized excavation, as well as remedial work directed by Engineer of Record, shall be without additional compensation.

I. Fill: Soil materials used to raise existing grades.

J. Geomembrane: Synthetic liner rated for direct burial to impede subsurface liquid transport.

K. Geotextile: Permeable synthetic fabric for soil separation or filtration.Non-Frost Susceptible Soils: Non-frost susceptible soils are inorganic soils containing less than 3 percent by weight of grains finer than 0.02 mm. The methods of test will be ASTM C 117, C 136, D 75, and D 422.

L. PFAS: Per- and polyfluoroalkyl substances are a group of man-made chemicals that includes perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS).

M. Pipe Zone: Interval of backfill around a buried pipe extending from the bottom of the pipe to a level of 1 foot over the top of the pipe.

N. Spring Line: Horizontal line coincident with the centerline of a buried pipeline.

O. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

P. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

Q. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

R. Trench Excavation: Any excavation for a pipeline or appurtenance.

S. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without recommendation by the Engineer of Record and approval by Developer. Unauthorized excavation, as well as remedial work recommended by the Engineer of Record and approved by Developer, shall be at the Contractor's expense.

T. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Warning tapes.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 1557.

C. Preconstruction Submittals:
   1. Excavation and Trenching Plan: No less than 30 days prior to the anticipated start of excavation activities, submit for approval a detailed plan for all proposed structure excavation, trenching, bracing, and shoring activities. Excavation and trenching plan shall conform to:
      a. Be prepared by a Professional Engineer registered in the State of Alaska.
      b. Occupational Safety and Health Act's (OSHA) excavation standards outlined in 29 CFR Part 1926, Subpart P.
      c. If stability of pavements, sidewalks, guardrails, and related structures is endangered by excavations then shoring or bracing designed by a qualified person shall be provided to ensure stability of structures and protect working personnel. Underpinning and undercutting shall not be allowed as part of the excavation and trenching plan.
      d. At a minimum, the excavation and trenching plan shall include:
         1) Complete details and substantiating calculations, sealed by a Professional Engineer registered in the State of Alaska.
         2) Activity Hazard Analysis (AHA) that defines all proposed steps being performed within the excavation and trenching activities. The AHA shall identify work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel, and the control measures to be implemented.
         3) Complete details of all protective systems proposed. Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.
         4) Methods and locations for egress into work area.
         5) Documentation that examination of the ground provides no indication of a potential cave-in.
         6) Rescue plan and procedure that contains provisions for self-rescue and assisted rescue of any working who is buried during a cave-in including rescue equipment.

7) Diagram or sketch of work area where work is to be performed, with adjacent and nearby structures and roadways shown.
8) Projected maximum depth of excavation.
9) Projected soil type classification and method of testing or justification to determine soil type.
10) Planned method of shoring, sloping, and/or benching.
11) Planned method for confined space entry, trench access and egress, and atmospheric monitoring process (if applicable).
12) Proposed methods for preventing damage or impacts to adjacent pavements, sidewalks, guardrails, and other structures designated to remain within or adjacent to the construction work area.
13) Plan for management of excavated soil/asphalt/concrete.
14) Plan for traffic control.
15) Digging permits (Excavation permits). All underground lines/utilities (communication lines, water, fuel, electric lines) shall be located and protected from damage or displacement.
16) Utility companies and other responsible authorities shall be contacted to locate and mark the locations and, if they so desire, direct or assist with protecting the underground installations.

e. Do not mobilize excavation and trenching equipment to the site without an approved excavation and trenching plan.

f. Submit all revisions to the approved excavation and trenching plan to the Engineer for approval. For all equipment not previously identified in the excavation and trenching plan, include in the submittal all of the information required above for the excavation and trenching plan. Explain to the Engineer, in writing, which portions of the approved excavation and trenching plan will be superseded by the revision and which portions remain unchanged. Allow at least 5 days for the Engineer's approval of excavation and trenching plan revisions.

1.07 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.08 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from City and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by City or authorities having jurisdiction.

B. Utility Locator Service: Notify the Alaska Dig Line for area where Project is located a minimum of 24 hours before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 01 Section "Temporary Facilities and Controls" and Division 31 Section "Site Clearing," are in place.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
1. Plasticity Index: 6.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, OL, CH, MH, ML, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Base Course (D-1 and E-1): Aggregate shall be crushed stone or crushed gravel, and shall consist of sound, tough, durable pebbles or rock fragments of uniform quality. All material shall be free from clay balls, vegetable matter or other deleterious matters. In addition, aggregate shall meet the following requirements:

Percent of Wear	AASHTO T 96	50 max.
Degradation Value	ATM T 313	45 min.
Percent Fracture	WAQTC FOP for AASHTO TP 61	70 min.

1. Gradations shall conform to the following requirements, as determined by WAQTC FOP for AASHTO T 27/T 11:

AGGREGATE FOR BASE

Sieve Designation	D-1 Percent Passing by Weight Grading	E-1 Percent Passing by Weight Grading
1-inch	100	100
3/4-inch	70 - 100	70 - 100
3/8-inch	50 - 80	50 - 85
No. 4	35 - 65	35 - 65
No. 8	20 - 50	20 - 50
No. 40	6 - 30	15 - 30
No. 200	0 - 6	8 - 15

E. Subbase: Hard, durable particles or fragments of stone or gravel containing no muck, frozen material, roots, sod, or other deleterious matter. Liquid limit not greater than 25 as tested by ATM 204. Plasticity index not greater than 6 as tested by ATM 205.

Percent of Wear	AASHTO T 96	50 max.
Degradation Value	ATM 313	40 min.

1. Meet the following gradation as tested by ATM 304:

GRADING

Sieve Designation	A	B	C	D	E
4-inch	100	-	-	-	-
2-inch	85-100	100	-	-	-

	GRADING				
Sieve Designation	A	B	C	D	E
1-inch	-	-	100	-	-
3/4-inch	-	-	-	100	-
No. 4	15-60	15-60	40-75	45-80	-
No. 16	-	-	20-43	23-50	-
No. 200	Less than 10	Less than 6	4-10	4-12	0-6

F. Selected Material, Type A: Aggregate containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as tested by ASTM 204 and ATM 205. Meet the following gradation as tested by ATM 304:

Size	Percent Passing
No. 4	20-60
No. 200	Less than 6 (based on the 3-inch minus fraction)

G. Bedding Course: Uniformly graded pea gravel meeting the gradation requirements in the table below if wet conditions are encountered:

Size	Percent Passing
3 inch	100
No. 4	20-60
No. 200	Less than 6 (based on the 3-inch minus fraction)

1. For dry conditions: Uniformly graded pea gravel as specified above or Pit Run gravel material meeting the requirements in the table below, containing no frozen, organic, muck, wood debris, or other deleterious material.

Size	Percent Passing
2-inch	100
No. 4	30 – 85
No. 60	35 max
No. 200	Less than 5

H. Drainage Rock and Leach Rock: Washed, uniformly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 4-inch sieve and not more than 5 percent passing a 1-inch sieve. This material shall be free of silt and clay particles adhering to the rock.

I. Common Fill: Subsoil materials used for fill and backfill shall be free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and deleterious or objectionable materials and shall not contain unsuitable material and frozen material. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.02 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide

and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Blue: Water systems.

B. Filter Fabric: Meet AASHTO M 288 for separation (Class 3). Fabric must be nonwoven and meet the following requirements: AMOCO 4547 or equal.
   1. Grab Tensile Strength: Minimum 112 pounds as determined by ASTM D 4632.
   2. Puncture Strength: Minimum 40 pounds as determined by ASTM D 4833.
   3. Elongation: Minimum 50 percent as determined by ASTM D 4632.

C. Geotextile: Geotextile shall meet AASHTO M 288 for separation (Class 2). Fabric must be nonwoven with an elongation greater than or equal to 50 percent.
   1. Permittivity: Minimum of 0.05 per second as determined by ASTM D 4491.
   2. Apparent Opening Size: Equal to or between the No. 70 and No. 100 as determined by ASTM D 4751.

D. Geogrid: Geogrid shall meet ASTM D6637. Mirafi BXG120, or equal.

Mechanical Properties	Minimum Average Roll Value
2% Strain Tensile Strength by ASTM D6637	410 lb/ft (MD) 620 lb/ft (CD)
5% Strain Tensile Strength by ASTM D6637	810 lb/ft (MD) 1340 lb/ft (CD)
Ult. Strain Tensile Strength by ASTM D6637	1310 lb/ft (MD) 1970 lb/ft (CD)
Grid Aperture Size	1.0 (MD) 1.3 (CMD)
Resistance to Installation Damage	95% (SC), 93% (SW), 90% (GP)
Resistance to Long Term Degradation	100%
Resistance to UV Degradation	100%

E. Insulation: Extruded polystyrene board insulation, Type VII: ASTM C578, 60 psi minimum compressive strength.
   1. Thermal resistance value (R-value) under heated structure:
      a. Horizontal insulation: 1.7 hr-ft^2 ◦F/BTU
      b. Vertical insulation: 6.7 hr-ft^2 ◦F/BTU
      c. Corner insulation: 4.9 hr-ft^2 ◦F/BTU
   2. Thermal resistance value (R-value) under unheated structure:
      a. Horizontal insulation: 10.9 hr-ft^2 ◦F/BTU
   3. The required R-values shown above should be divided by the R factor (R per inch) of the insulation board selected for construction to determine the thickness of insulation required in the vertical, central horizontal, and corner horizontal areas of the building to protect the foundation from frost action.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 EXPLOSIVES

A. Explosives: Do not use explosives.

3.03 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.04 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.05 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: As indicated on Drawings.

C. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

3.06 SUBGRADE INSPECTION

A. Notify Engineer of Record when excavations have reached required subgrade.

B. If Engineer of Record determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
   1. If peat or organic soils are encountered, these soils should be excavated and removed to a minimum depth of 3 feet from the pipe base.

C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

D. Seasonally frozen soil within 2 feet of base of trench shall be allowed to thaw and base of trench shall be uniformly and systematically compacted to achieve required compaction in first lift of fill.

E. If the soils are too wet to compact or pumping occurs, the Contractor has three options:
   1. Wait and allow silty soils to dry naturally.
   2. Till or otherwise accelerate the natural drying of the wet soils by mechanical means.
   3. Excavate an additional 1 foot of subgrade, install a geosynthetic separator, and float an initial 1-foot-thick lift of structural fill on top of the separator.

F. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer of Record, without additional compensation.

3.07 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer of Record.

3.08 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
   2. Following requirements of Section 9 of Contaminated Materials Management Plan (CMMP).

3.09 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing trash and debris.
   5. Removing temporary shoring and bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Coordinate backfilling with utilities testing.

C. Clean material must be placed 18-inches above the pipe.

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use structural fill soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under structures and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 0.10 foot.
   2. Walks: Plus or minus 0.05 foot.
   3. Pavements: Plus or minus 0.05 foot.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Place base course material over subbase course under hot-mix asphalt pavement.
   2. Shape subbase course and base course to required crown elevations and cross-slope grades.
   3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.

4. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.16 GEOFABRIC

A. Geotextile and Filter Fabric. Under this section, referred to commonly as "geotextile."
   1. Storage: If stored outdoors for a prolonged period, geotextile must be elevated from the ground and covered under a tarpaulin or opaque plastic.
      a. Contractor shall ensure rolls are adequately protected from:
         1) Moisture
         2) Ultraviolet radiation
         3) Chemicals such as strong acids or bases
         4) Temperatures in excess of 120°F
         5) Animal destruction
         6) Theft
   2. Construct the surface underlying the geotextile smooth and free of ruts, deleterious material such as sharp objects or large protruding rocks which could damage the geotextile. When placing above rip rap, flatten rip rap surface to minimize exposed particle edges and reduce the risk of tearing.
   3. Install geotextile in accordance with manufacturer's recommendations.
   4. Hand place geotextile. No equipment shall be permitted to pull, stretch, or hold down geotextile. Place geotextile without folds or wrinkles, and avoid stretching and tearing the geotextile.
   5. Orient the geotextile with the machine (roll) direction parallel to the direction of water flow.
   6. If required, use key trenches where terminating geotextile into adjacent soil.
   7. For joining, overlap geotextile a minimum of 3 feet. Successive sheets must be overlapped upstream over downstream in a "shingle effect."
   8. Fill. Place cover soil in accordance with this Section:
      a. Use adequate ballast to prevent uplift by wind.
      b. Do not leave the geotextile uncovered for more than 14 days.
      c. Begin fill layer over geotextile at seams to maintain overlap.
      d. Fill remaining areas with initial lift to protect geotextile.
   9. Repairs: In lieu of specific manufacturer guidelines, overlap any damaged geotextile by a minimum of 3 feet in all directions from the damage or defect. Replace geotextile that cannot be repaired.

B. Field Quality Control: Notify Engineer for inspection of geotextile, and correct any deficiencies prior to placement of backfill.

C. Backfill: Place fill around geomembrane to prevent stretching and tearing. Where geomembrane is positioned in the vertical plane, use temporary means to hold geotextile in position as fill is placed on either side of geotextile until completely buried.

D. Geomembrane Repair: Clean the damaged area. Place a patch of the same type of geomembrane which extends a minimum of four inches beyond the edge of damage or defect. Thermally fuse patch to geomembrane. Replace geomembrane that cannot be repaired.

E. Quality Control:

1. In-Factory Seaming:
   a. 100% Visual Inspection by two persons. Inspect every third seam on both sides of the geomembrane. Factory seams shall be visually inspected for full seam continuity over their full length by providing tension perpendicular to seam. Any defective areas shall be removed and repaired.
   b. Destructive Testing. Destructive tests shall be performed per ASTM D6392.
2. Field Testing. 100% Visual Inspection at each installed location. All damaged or defective areas shall be removed and repaired.
   a. Marking: Indelibly mark all installed boots passing inspection with the date of inspection and initials of inspector at the twelve o'clock position on the boot.

3.17 GEOGRID

A. Prepare the ground by removing stumps, boulders, etc. and fill in low spots. Unroll the geogrids directly over the ground to be stabilized. If more than one roll width is required, overlap rolls with at least 3 feet of overlap. End seems shall be staggered by a distance equal to the roll width.

B. Place the aggregate onto previously installed geogrid.

C. Traffic on top of the initial lift over the geogrid should travel in straight lines to prevent damage.

3.18 INSULATION

A. Insulation shall be protected in accordance with Section 4.1.4 of the SEI/ASCE 32-01.

B. 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.

C. Polystyrene insulation should not be exposed to petroleum-based products.

D. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation.

E. Vertical insulation placed externally on foundation walls or along edges of slab-on-grade floors should have an opaque and weather-resistant protective covering to mitigate degradation of thermal performance from ultraviolet radiation, physical damage, or other sources of deterioration.

F. Horizontal insulation placed less than 12 inches below the ground surface, or any portion extending outward more than 24 inches from the foundation edge, should be protected against damage by concrete or asphalt pavement on the ground surface directly above the insulation by cementitious board or plywood rated for below-ground use, or by other approved materials placed directly on the top surface of the insulation.

G. Install insulation with manufacturer's R-value label exposed after the insulation is installed.

H. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2922, and Alaska Test Method T-11. Tests will be performed at the following locations and frequencies:
   1. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
   2. Road, Parking, and Developed Areas: At subgrade and at each compacted fill and backfill lift, perform at least one field in-place density test for every 2,000 square feet or less of area, but in no case fewer than three tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Engineer of Record; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off City’s property.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Additional Excavation and Backfill: Shall be measured using the limits specified in the written authorization for the work issued on-site by the Engineer to compute the in-place cubic yardage. This is only to include additional work and material required in the case where poor soil is encountered.

B. Gravel Road Resurfacing: Shall be measured based on the area reconstructed within in the limits of disturbance.

C. Ditch Realignment: Shall be measured based on linear foot.

4.02 BASIS OF PAYMENT

A. Payment for earthwork bid items shall include furnishing all necessary material, personnel, equipment, transportation, and supplies to perform the work as shown and specified.

B. Payment for all other materials and work specified in this Section is subsidiary.

Pay Item Number	Pay Item	Pay Unit
312000-1	Additional Excavation & Backfill	Cubic Yard
312000-2	Gravel Road Resurfacing	Square Yard
312000-3	Ditch Realignment	Linear Foot

END OF SECTION

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes construction dewatering.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.03 DEFINITIONS

A. ADEC: Alaska Department of Environmental Conservation

B. PFAS: Per- and polyfluoroalkyl substances are a group of man-made chemicals that includes perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS).

1.04 INFORMATIONAL SUBMITTALS

A. Preconstruction Submittals:

1. Dewatering Work Plan.
2. Notice of Intent for coverage under the ADEC Alaska Pollutant Discharge Elimination System (APDES) General Permit for Excavation Dewatering.
3. ADEC Discharge Authorization.

B. Closeout Submittals:

1. Notice of Termination for coverage under APDES General Permit for Excavation Dewatering.

1.05 SPECIAL ENVIRONMENTAL REQUIREMENTS

A. Comply with the special environmental requirements listed in Article 3.01 DEWATERING and on ESCP sheets.

B. Comply with the requirements listed in Section 8 in the Contaminated Materials Management Plan.

1.06 REGULATORY NOTIFICATIONS

A. Provide Notice of Intent and final dewatering work plan in accordance with APDES General Permit AKG002000 for Excavation Dewatering. Submit copies of regulatory notifications to the Engineer of Record at least 14 days prior to commencement of work activities.

1.07 REGULATORY NOTIFICATION AND PERMITS

A. Obtain coverage under APDES General Permit AKG002000 for Excavation Dewatering. Groundwater in this area is known to have the following contaminants in concentrations exceeding ADEC cleanup levels: PFOS and PFOA. Permit coverage shall be obtained at no additional cost to the Government.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 DEWATERING

A. Dewatering shall be limited to that necessary to install water line. All methods to install water line in water is preferred.

B. Construction operations for dewatering must be constantly controlled to comply with the State of Alaska Construction General Permit and Excavation Dewatering Permit. Use erosion prevention and sediment control Best Management Practices (BMPs) to prevent construction site runoff from entering the excavation. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to lands or surface waters.

3.02 DEWATERING WORK PLAN

A. Submit a Dewatering Work Plan within 30 calendar days after notice to proceed. No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. Allow 14 calendar days in the schedule for review.

B. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan.

C. The Dewatering Work Plan shall be prepared in accordance with the most recent version of the BMP Plan Template issued by the Alaska Department of Environmental Conservation (ADEC) Division of Water Quality, located at:

https://dec.alaska.gov/media/6708/bmp-plan-template.docx.

D. The State of Alaska and EPA have agreed to a generally acceptable approach to excavation dewatering activities in the PFAS-contaminated groundwater areas. This approach includes:

1. Keeping groundwater from the excavation within the overall footprint of the project.
2. Locating the water discharge point below the local groundwater table. This level may vary from that indicated on plan drawings due to seasonal variations.
3. Incorporating site-specific requirements into the dewatering work plan to address potential hazards based on contaminants present on site (liberation of volatile compounds, direct contact hazards, etc.).

E. Information regarding this approach is shown in the ESCP drawings.

3.03 NOTICE OF INTENT FOR EXCAVATION DEWATERING

A. Prepare and submit the Notice of Intent (NOI) for APDES coverage under General Permit AKG002000 for Excavation Dewatering and associated Dewatering Work Plan to the

Engineer of Record for review and approval. The permit documents, forms, and further permit information can be accessed at the following location:

http://dec.alaska.gov/water/wastewater/stormwater/dewater-hydrostatic/

B. Submit the approved NOI, Dewatering Work Plan, and appropriate permit fees to the ADEC Division of Water. No land disturbing activities ultimately requiring excavation dewatering may commence without permit coverage.

C. Maintain an approved copy of the Dewatering Work Plan at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

D. Submit a copy of the ADEC authorization to the Engineer of Record within seven (7) days of receipt of authorization and prior to conducting any ground-disturbing activity on site.

3.04 NOTICE OF TERMINATION FOR EXCAVATION DEWATERING

A. Submit a Notice of Termination (NOT) to the Engineer of Record for approval once excavation dewatering activities are complete on all portions of the site for which the permittee is responsible. Once approved, submit the Notice of Termination to the ADEC Division of Water.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Dewatering: Dewatering will not be measured since it is a lump sum item.

4.02 BASIS OF PAYMENT

A. Payment for Dewatering items by the Contractor shall include furnishing all necessary material, personnel, equipment, transportation, and supplies to perform the work as shown and specified.

Pay Item No.	Pay Item	Pay Unit
312119-1	Dewatering	Lump Sum

END OF SECTION

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SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Hot-mix asphalt patching.
2. Hot-mix asphalt paving.
3. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.02 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Fifteen days prior to the production of asphalt concrete, the Contractor shall submit his proposed mix design and a certified laboratory test showing the property curves for the hot mix design data by the Marshall Method.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each paving material, from manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the State of Alaska Department of Transportation & Public Facilities (DOT&PF).

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of DOT&PF for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 40 deg F.
2. Asphalt Surface Course: Minimum surface temperature of 40 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: Coarse aggregate (that material retained on the No. 4 Sieve) shall be crushed stone or crushed gravel and shall consist of sound, tough, durable rock of uniform quality. All material shall be free from clay balls, vegetative matter or other deleterious matters. Coarse aggregate shall not be coated with dirt or other finely divided mineral matter. In addition, coarse aggregate shall meet the following:

Percent of Wear	AASHTO T 96	45 max.
Degradation Value	ATM T313	30 min.
Percent Sodium Sulfate Loss	AASHTO T-104	9 max. (5 cycles)
Percent Fracture	WAQTC FOP for AASHTO TP 61	80 min. single face
Thin – Elongated Pieces	ATM 306	8% max.
Absorption, % max	ATM 308	2.0

C. Fine Aggregate: Fine aggregate (passing the No. 4 Sieve) shall meet the quality requirements of AASHTO M 29, including S1.1, Sulfate Soundness Test.

D. Blended Aggregate: The several aggregate fractions for the mixture shall be sized, graded, and combined in such proportions that the resulting composite blend conforms to the grading requirements shown in the table below. The fraction actually retained between any two consecutive sieves larger than the No. 100 shall be not less than 2 percent of the total. Aggregate gradations shall be determined by WAQTC FOP for AASHTO T 27/T 11. The size of extracted samples for gradation shall be in conformance with AASHTO T-164.

BROAD BAND GRADATIONS FOR
ASPHALT CONCRETE PAVEMENT AGGREGATE
Percent Passing by Weight

Sieve Designation	Gradation Designation Type II
3/4-inch	100
1/2-inch	75-90
3/8-inch	60-84
No. 4	33-70
No. 8	19-56
No. 16	10-44
No. 30	7-34
No. 50	5-24
No. 100	4-16
No. 200	4-7

E. The full tolerances specified below shall be applied to the approved Job Mix Design gradations and shall not be limited to the broad bands listed in paragraph 2.01D. Tolerances shall not be applied to the largest specified screen.

Sieve Size or Item	Tolerance % Passing
3/4-inch	+/-8
1/2-inch	+/-7
3/8-inch	+/-7
No. 4	+/-7
No. 8	+/-6
No. 16	+/-6
No. 30	+/-5
No. 50	+/-4
No. 100	+/-3
No. 200	+/-3
Asphalt %	+/-0.4

F. Filler: Shall conform to requirements of ASTM M-17.

2.02 ASPHALT MATERIALS

A. Asphalt Cement: Type and grade shall be PG 52-28 and shall meet applicable requirements of AASHTO M 320.

B. Tack Coat: CSS-1 cationic emulsified asphalt conforming to applicable requirements of Section 702 of ADOT&PF Standard Specification.

C. Water: Potable.

2.03 AUXILIARY MATERIALS

A. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

1. Color: White or Yellow to match existing.

2.04 MIXES

A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes conforming to ADOT&PF Type II, Class B, designed according to procedures in ATM 417; and complying with the following requirements:

1. The Engineer of Record shall approve the job mix design prior to the Contractor placing any asphalt concrete on the job.

2.05 HAULING EQUIPMENT

A. Trucks used for hauling asphalt mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a minimum amount of paraffin oil, lime solution or other approved material to prevent the moisture from adhering to the beds. Oil or diesel fuel shall not be used. Each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather, when necessary, so that the mixture will be delivered on the road at the specified temperature.

B. Dumping of material in a windrow and then placing the material in the asphalt paver with pickup equipment will be permitted, if the asphalt paver is of such design that the material will fall into a hopper which has movable bottom conveyor(s) to feed the screed and the pickup equipment is constructed so that substantially all of the material deposited on the roadbed is picked up and deposited in the paving machine. Use of the pick-up equipment will be discontinued if its use produces segregation, excessive temperature loss or other lay down problems.

C. The temperature drop of the asphalt mixture, taken immediately behind the screed, shall not be more than 30 deg F less than the temperature of the material in the hauling unit, taken immediately after loading from the plant or surge bin.

2.06 ASPHALT PAVERS

A. Asphalt pavers shall be self-contained, power-propelled units, provided with an activated screed or strike-off assembly, heated, if necessary, and capable of spreading and finishing courses of material in lane widths applicable to the specified typical section and thicknesses shown on the plans. Pavers shall be equipped with a paver control system, which shall automatically control the laying of the mixture to specified transverse slope and specified longitudinal grade. The paver control system shall be automatically actuated by the use of a mobile string line, ski, or other approved grade follower. Such mobile string line or ski shall be a minimum of 30 feet in length, shall be attached to the roadway centerline side of the paver by a linkage system that does not in any way bind or prevent the mechanism from truly following the grade, and shall be a product manufactured by a company regularly engaged in the production of equipment for this specific automatic paver control system use. The length of the ski, mobile string line, or other device shall be adjusted to whatever practical maximum is necessary to produce the intended smooth-riding surface. The kind of grade follower used and the type of automatic paver control system used shall be compatible and shall be optional with the Contractor, subject to demonstrated ability thereof to provide complete pavement fully conforming to all specified requirements. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of material in widths as shown on the plans. Paver extensions shall include auger, activated screed or strike-off assembly and provisions for heating.

B. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

C. In order to conform as closely as possible with the specified depth of wearing course, variations in existing cross slopes shall be controlled through the transverse adjusting mechanism on the paver.

D. The screed or strike-off assembly shall produce a finished surface of required evenness and texture without tearing, shoving or gouging the mixture.

E. When laying mixtures, the paver shall be operated at forward speeds consistent with plant production.

F. Pavers shall be kept in full operating condition and in good repair and adjustment at all times.

2.07 ROLLER

A. Rollers shall be of the steel wheel and/or pneumatic tire type, self-propelled, in good condition, capable of reversing without backlash, and operated at speeds slow enough to avoid displacement of the asphaltic mixture. The number and weight of the rollers shall be sufficient to compact the mixture to the required density and surface smoothness while it is still in a workable condition and capable of maintaining the pace of the paving operation. The use of equipment that results in crushing to the aggregate will not be permitted. All rollers shall have suitable equipment for keeping rollers or tires clean and efficiently dispersing water to the contact surfaces to prevent mixture pick-up. The use of fuel oil on rubber tires or steel rollers will not be permitted. Skirting or other approved devices shall be maintained on pneumatic rollers for heat retention.

B. The Contractor will be required to furnish a minimum of one pneumatic-tired roller, and one 2-axle tandem steel wheel roller (10-ton minimum weight) for each asphalt paver, with a separate operator for each roller.

C. A vibratory roller may be used as the finish roller if it meets the requirements for a finish roller, and it is operated with the vibrating unit turned off.

D. Rollers used for initial breakdown rolling shall be equipped with rolling wheels having a diameter of 40 inches or more.

E. Pneumatic-tired rollers shall be oscillating type having a width of not less than 4 feet and equipped with pneumatic tires of equal size and diameter, having satisfactory treads. The rear group of tires shall align behind and cover the spaces between the forward groups of tires. Wobble-wheel rollers will not be permitted. Tires shall be inflated to 90 psi or such lower pressure as designated and maintained so that the air pressure will not vary more than 5 psi from the designated pressure. Pneumatic tired rollers shall be so constructed that the total weight of the roller can be varied to produce an operating weight per tire of not less than 2,000 pounds. The total operating weight of the roller shall be varied as directed.

F. Vibratory rollers with separate controls for energy and propulsion and especially designed for asphaltic pavement compaction may be used in accordance with the limits stated in this subsection. Vibratory rollers will not be allowed for compaction of new pavements unless all phases of construction have been compacted by vibratory means except that they may be used

for compaction of overlays of existing pavements. Vibratory rollers are not to be used when it is determined that such usage may cause a decrease in stability of the pavement structure.

G. Poorly performing rollers may be rejected and replaced with suitable equipment or supplemented as may be necessary to accomplish the desired results.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.03 HOT-MIX ASPHALT PLACING

A. All concrete curb and gutter must be in place and have cured for at least 72 hours before placing asphalt.

B. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt surface course in single lift.
2. The mixture shall leave the plant at a temperature between 290 deg F and 325 deg F and shall be spread at a temperature of not less than 280 deg F. Any batch of mixture that has been heated to a temperature greater than 325 deg F shall be dumped and removed from the plant. Such overheated material shall not be used in the pavement.
3. Begin applying mix along the low side of the street and progress to the high side.
4. Placing of the asphalt paving shall be as continuous as possible.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

C. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.

D. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.04 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints. The application shall be uniformly and thinly sprayed on. Care and protection shall be provided to avoid accumulation or overspray.
2. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.05 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers. Plan rolling pattern such that steel wheel rollers do not roll over areas of portland cement concrete pavement.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 94 percent of reference laboratory density according to ATM 409 (Alaska Test Method), but not less than 92 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.06 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Asphalt thickness shall be accepted when 75 percent of the cores are within 0.15 inch of the specified thickness and no core shows a deficient thickness more than 0.25 inch below design thickness.

B. Surface Smoothness: Compact to produce a surface smoothness within the following tolerances as determined by using a 16-foot straightedge applied transversely or longitudinally to paved areas:

1. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not exceed 3/16 inch.

C. Cracking: Ensure that method of compaction does not produce cracking or "checking" in the asphalt concrete mat. Any area with transverse cracking, spaced 2 inches apart or closer, and extending at least 1/2 inch in depth, will not be accepted.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Developer may, at his sole option, core asphalt to test for thickness and density.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Field density of in-place compacted pavement shall be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726. Two tests shall be taken of the paved surface.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

G. Contractor to provide asphalt pavement patches at all core sample locations.

3.08 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Hot Asphalt Pavement: Shall be measured based on the number of tons placed as determined from delivery weight tickets.

B. Driveway Asphalt: Shall be measured based on the square yardage of the asphalt placed. Generally the thickness shall be 2-inches.

4.02 BASIS OF PAYMENT

A. Payment for hot-mix asphalt paving pay items shall include furnishing all necessary material, personnel, equipment, transportation and supplies to perform the work as shown and specified. This shall include roadways and approaches. Pavement markings shall be subsidiary.

B. Payment for hot-mix asphalt will not be paid until after the installation of hot-mix asphalt.

C. Payment for driveway asphalt shall include furnishing all necessary material, personnel, equipment, transportation and supplies to perform the work needed to repair driveways.

D. Removal and reinstallation of existing signs shall be subsidiary to the water main pay items.

Pay Item Number	Pay Item	Pay Unit
321216-1	3” Hot-Mix Asphalt	Ton
321216-2	Driveway Asphalt	Square Yard

END OF SECTION

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SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Horizontal-slide, motor-operated gates.
3. Vehicle Access Gates
4. Personnel gates

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete for operator bases/pads, vehicle access gate posts, and fence post footings.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Accessories: Barbed wire.
d. Gates and hardware.
e. Gate operators, including operating instructions and motor characteristics.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.
3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
4. Wiring Diagrams: For power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1. Emergency Access Requirements: According to the requirements of the Authorities Having Jurisdiction for gates with automatic gate operators serving as a required means of access.

1.06 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Field Measurements: Verify layout information for vehicle access gates shown on Drawings in relation to existing terrain and tree lines.

1.07 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of gate operators and controls.

2. Warranty Period: Five years from date of Substantial Completion. Frost heaving may be excluded.

PART 2 - PRODUCTS

2.01 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 9 gauge (0.1532inch.

a. Mesh Size: 2 inches.
b. Zinc-Coated Fabric: ASTM A 392-96, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before weaving.

3. Selvage: Twisted top and knuckled bottom.

2.02 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 Group 1C for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 Group 1C based on the following:

1. Fence Height: As indicated on Drawings.
2. Heavy-Industrial-Strength Material: Group 1C, SS-40, round steel pipe, electric-resistance-welded pipe.
    a. Line Post: 2-3/8 inches (2.375 inches in diameter, 60-inch driven embedment.
    b. End, Corner, and Pull Posts: 2-7/8 inches (2.875 inches in diameter, 60-inch embedment (minimum 3.5-foot concrete embedment below 1.5-foot NFS soil embedment). Minimum 10-inch post footing diameter.
    c. Cantilevered Sliding Gate Posts: 4.0 inches in diameter.
3. Brace Rails and Truss Rods: 1-5/8-inch brace rail and 3/8-inch truss rod. ASTM 1043 Group 1C.
4. Metallic Coating for Steel Framework:
    a. Type A: Not less than minimum 2.0-oz/sq. ft. average zinc coating according to ASTM A 123/A 123M.

2.03 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch-diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:

1. Type II: Zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
    a. Class 4: Not less than 1.2 oz./sq. ft. of uncoated wire surface.

2.04 HORIZONTAL SLIDE GATES

A. General: Single chain link cantilever slide gates, posts, hardware manufactured to comply with ASTM F 1184. Provide automated vehicular gates according to ASTM F 2200 and UL 325.

1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
    a. Gate Frame Dimensions: As indicated.

B. Gate Frames:

1. Pipe and Tubing:
    a. Zinc-Coated Steel: Protective coating and finish to match fence framework.
    b. Gate Posts: ASTM F 1184. Provide round tubular steel posts.
    c. Gate Frames and Bracing: Round tubular steel.
2. Frame Corner Construction: Welded.
3. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain link fabric at both ends of gate frame 12 inches as required to attach barbed wire assemblies.

4. Hardware:

    a. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.

C. Gate Opening: Per plans.

D. Gate Frame Finish: Galvanized Steel

E. Chain Link Filler Finish: To match specification of adjacent fence. Chain link mesh size, and wire gauge to match that of existing fence. Fabric shall be attached between each internal upright with hook bolts spaced no more than 15 inches on center as recommended by manufacturer.

2.05 FITTINGS

A. Provide fittings according to ASTM F 626.

B. Post Caps: Provide for each gate post.

1. Provide line barbed wire arms with loop to receive tension wire.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

1. Rail Sleeves: Pressed Steel or round steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails to posts.

D. Tension and Brace Bands: Pressed steel.

E. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

F. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

G. Barbed Wire Arms: Pressed steel, with slots for attaching strands of barbed wire, for each post unless otherwise indicated, and as follows:

1. Provide line posts with arms that accommodate top rail or tension wire.
2. Provide corner arms at fence corner posts unless extended posts are indicated.
3. Single-Arm Type: Type I, slanted arm.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

    a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire.

I. Finish:

1. Metallic Coating for Pressed Steel: Not less than 1.2 oz./sq. ft. of zinc.

2.06 BARBED WIRE

A. Steel Barbed Wire: ASTM A 121, double-strand barbed wire, 0.099-inch-diameter line wire with 0.080-inch-diameter, four-point round barbs spaced not more than 5 inches o.c.

1. Zinc Coating: Type Z, Class 3.
2. Fence: Three strands of equally-spaced barbed wire attached to barb wire support arms on straight segments, and corner barb wire arms at corners; single strand barbed wire at top of fence fabric.

2.07 GATE OPERATORS

A. Operators: Factory-assembled, automatic, gate-operating system designed for gate size, type, weight, and frequency of use. Control system shall have characteristics suitable for Project conditions, with control stations, safety devices, and weatherproof enclosures.

1. Operator design shall allow for removal of cover or motor without disturbing limit-switch adjustment and without affecting auxiliary emergency operation.
2. Electronic components shall have built-in troubleshooting diagnostic feature.
3. Unit shall be designed and wired for both right-hand/left-hand opening, permitting universal installation.
4. Operator shall be installed on the secure side of the fence to prevent tampering.

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.

C. UL Standard: Manufacture and label gate operators according to UL 325.

D. Motors: Comply with NEMA MG 1.

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
2. 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.
3. Service Factor: 1.15.
4. Electrical Characteristics:

a. Cantilevered Gates:

1) Horsepower: 1/2 hp (minimum).
2) Voltage: 2120 V ac, single-phase, 60 Hz.

E. Gate Operators: Equipment base/pad mounted and as follows:

1. Mechanical Cantilevered Slide Gate Operators:

a. Duty: Medium duty, commercial/industrial.
b. Gate Speed: Minimum 45 feet per minute.
c. Maximum Gate Weight: 600 lb.
d. Frequency of Use: 4 cycles per day.
e. Operating Type: Roller chain, with manual release.

f. Drive Type: Enclosed worm gear and chain-and-sprocket reducers, roller-chain drive.
g. Lift Master AC Heavy-Duty Industrial Slide Gate Operator Model CSL24U or approved equal.

F. Operating Type: Screw.

G. Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA 250, Type 3R enclosure for pedestal mounting and with space for additional optional equipment.

H. Control Devices:

1. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna and coaxial cable and mounting brackets designed to operate gates. Provide two programmable transmitter(s) with multiple-code capability, permitting validating or voiding of not less than 1,000 codes per channel configured for the following functions:

a. Transmitters: Single-button operated, with open and close function.
b. Compatible with LiftMaster CSL24UL.

I. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.

a. Where indicated on Drawings.

4. Photoelectric/Infrared Sensor: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

J. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully open and fully closed positions.

K. Emergency Release Mechanism: Quick-disconnect release of operator drive system, permitting manual operation if operator fails. Control circuit power is disconnected during manual operation.

1. Type: Mechanical device, key, or crank-activated release.

L. Operating Features:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Open Override Circuit: Designed to override closing commands.

4. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
5. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.

M. Accessories:

1. Warning Module: Visual, strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.

    a. Fail Safe: Gate opens and remains open until power is restored.
    b. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.

3. External electric-powered magnetic lock with delay timer allowing time for lock to release before gate operates.
4. Fire box.
5. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
6. Equipment Bases/Pads: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.
7. Heater: Install operational heater to provide an operational service temperature range down to minus 40 deg F.

2.08 VEHICLE ACCESS GATE

A. Post and frame: Shop-fabricated and finished to slip over inner gate post embedded in concrete.

1. Outer Post: 6-inch SCH 80 (5.761” I.D.) carbon steel.

    a. Outer Post Cap: 3/8” plate steel, welded to outer post with 5/16” fillet welds.

2. Inner Post: 5-inch SCH 80 (5.563” O.D.) carbon steel.

    a. Inner Post Cap: 3/8” plate steel, recessed 3/8” from end of pipe welded to inner post with 3/8” fillet welds.

3. Gate Frame: Steel pipe truss welded to outer post.

    a. Top and Bottom: 3” SCH 40 carbon steel.
    b. Internal vertical members: 3” SCH 40 carbon steel.

B. Bearing Disk: Ultra High Molecular Weight Plastic, 4.5” diameter x ½”, fabricated to fit flat against inner post cap cavity.

C. Paint: Prepare all exposed surfaces, primer coat, intermediate coat, and two finish coats. This includes the exterior of the inner post.

1. Guarantee: A two (2) year guarantee which commences on the date of acceptance against failure of all coatings shall be provided. Failure of any coating during the guarantee period shall be repaired by the Contractor which shall absorb all costs related to the repair of the coating.

2. Standard: Unless otherwise specified, all work and materials for the preparation and coating of all metal surfaces shall conform to the applicable requirements specified in the Steel Structures Painting Manual, Volume 2, System and Specifications, latest edition, published by the Steel Structures Painting Council.
3. Finish coat color: Safety Red.

D. Grease: Low-temperature grease, applied liberally to bearing disk and exterior of inner pipe after concrete foundation has cured prior to outer pipe installation.

1. Product: Dow Corning Molykote 33 Extreme Low Temperature Grease or approved equal.

E. Signs: 1/8-inch flat aluminum sign panels that conform to ASTM B209, allow-temper 6061-T6, 5052-H36, or 5052-H38. The blanks must be free from laminations, blisters, open seams, pits, holes, or other defects that may affect their appearance or use. The thickness must be uniform and the blank commercially flat.

1. All background sheeting applied to flat sheet and extruded panel signs must be in accordance with ATSM D4956, Type III, IV, VII, VIII, IX, or XI retroreflective sheeting and must have Class 1, 3, of 4 adhesive backing. Retroreflective sheeting must be high intensity that is an un-metallized micro prismatic reflective material.
2. Hardware:

a. Fasten signs as indicated on the Drawings to vehicle access gates using perforated steel tubing.
b. Bolts, nuts, lock and flat washers must be either hot-dipped galvanized or commercial quality stainless steel. All accessible hardware shall be tamper resistant.

2.09 GROUT AND ANCHORING CEMENT

A. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, non-shrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.10 PERSONNEL GATE

A. General: ASTM F900 for gate posts and personnel gate.
1. Gate Leaf Width and Height: As indicated on Drawings
2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.
3. Gate Frame and Bracing: Round Tubular Steel, Welded.

B. Posts and Rails: ASTM F1043 Group 1C. Provide members with minimum dimensions and wall thicknesses according to ASTM F 1043 Group 1C based on the following:

a. Posts: 2-7/8 inches (2.875 inches) in diameter, 60-inch embedment (minimum 3.5-foot concrete embedment below 1.5-foot NFS soil embedment). Minimum 10-inch post footing diameter.

b. Extended Posts and Frame Members: Fabricate gate posts and frame members to extend 12 inches above top of chain-link fabric at both ends of gate frame to attach barbed wire assemblies, matching fence line construction.

C. Brace Rails and Truss Rods: As specified under Part 2.02 of this Section.

D. Chain Link Filler Finish: To match specification of adjacent fence. Chain link mesh size, and wire gauge to match that of existing fence. Fabric shall be attached between each internal upright with hook bolts spaced no more than 15 inches on center as recommended by manufacturer.

E. Gate Fittings: As specified under Part 2.05 of this Section with the following additional components:
1. Hinges: 180-degree swing. Bulldog Hinges or approved equal.
2. Latch: Permitting operation from both sides of the gate. DAC Industries Commercial Strong-Arm latch for round frame or approved equal.

F. Gate Accessories:
1. Keyed Padlock shall be provided by Owner.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fence boundary, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Engineer.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

B. Locate all existing and proposed underground utilities and piping which cross under the fence line.

3.03 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.

1. Install fencing as shown on design plan.

B. Post Setting: Set posts by mechanically driving into soil at indicated spacing into firm, undisturbed soil.

1. Verify no conflicts between posts and buried utilities exist.
2. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with mechanical devices.

3. Mechanically Driven Posts: Drive into soil to depth of 48 inches for line posts and 60 inches for terminal and corner posts. Protect post top to prevent distortion.

C. Sliding Gate Posts: Anchor posts in concrete at a depth of 60 inches. Place top of concrete 18 inches below grade and backfill remaining annular space with compacted NFS fill.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 10 feet on center.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
2. Extended along top of barbed wire arms and top of fence fabric to support barbed tape.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces and rails at 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

L. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

3.04 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation. Gate movement shall not be initiated by gravity when the operator is disengaged/disconnected per ASTM F-1184.

B. There shall be a maximum gap of 2-1/4 inches between the horizontal plane of the moving gate panel and any fixed obstacle (support posts, “fall-over” posts, hardware, etc.). Except that said obstacle be more than 16 inches from moving horizontal plane of the gate panel per ASTM F-2200 (Section 6.1.4).

C. Gate receiver guides shall be recessed behind the leading edge of the receiver post or another fixed object per ASTM F-2200 (Section 6.1.4).

D. Attach hardware by means which will prevent unauthorized removal. Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

E. Adjust hardware for smooth operation.

3.05 GATE-OPERATOR INSTALLATION

A. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate-operator component manufacturer's written instructions and as indicated.

C. Mounting: Mount opener on pedestal in accordance with manufacturer’s instructions.

D. Ground electric-powered motors, controls, and other devices according to NFPA 70 and manufacturer's written instructions.

3.06 VEHICLE ACCESS GATE INSTALLATION

A. Install posts and gates where shown in the Drawings.

B. Adjust post plumb, with height such that top of gate is between 40 and 45 inches measured vertically from gate midpoint to finished grade surface.

C. Setting posts:

1. Remove loose and foreign materials from holes and the soil moistened prior to placing concrete.
2. Provide tops of footings that are trowel finished and sloped or domed to shed water away from posts.
3. Maintain posts plumb set in concrete until concrete has set. Keep exposed concrete moist for at least seven consecutive calendar days after placement or cured with a membrane curing material, as approved.

D. Allow concrete base and inner post installation to cure a minimum of seven days prior to setting gate assembly.

E. Chains and Locks:

1. Use 3/16” hot-dipped galvanized chain as indicated on the Drawings. Provided padlocks keyed the same for each gate.

F. Signs:

1. Stop sign shall be installed level using tamper-resistant fasteners, where indicated on Drawings. Sign legend shall face vehicles approaching from outside the restricted property.

3.07 FIELD QUALITY CONTROL

A. Prepare test reports.

B. Field verify all keys provided to Owner unlock vehicle access gate padlocks. Leave gates in the locked position upon completion, and deliver three (3) sets of keys for locks to Owner.

3.08 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.

1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Test and adjust operators, controls, and safety devices. Replace damaged and malfunctioning controls and equipment.
3. Lubricate operator and related components.

C. Lubricate hardware and other moving parts.

3.09 CLEANING

A. Clean up debris and unused material and remove from site.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Vehicle Access Gate: Vehicle Access Gate shall be measured on a per each basis in place.

4.02 BASIS OF PAYMENT

A. Payment for Vehicle Access Gate will not be paid until installation is completed.

B. Payment for Chain Link Fences, Horizontal Slide Gates, and Operators is subsidiary to Pay Item 331100-11 Pump House.

END OF SECTION

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SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Seeding of disturbed areas.

1.02 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.05 INFORMATIONAL SUBMITTALS

A. Certification of grass seed.

1. Certification of each seed mixture.

B. Product certificates.

1.06 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Provide topsoil which is fertile, friable, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 3/4-inch in any dimension, and other extraneous or toxic matter harmful to plant growth. Topsoil shall have a pH between 6 and 7.6, contain from 15 to 35 percent organic matter as determined by the Organic Carbon 6A, Chemical Analysis Method described in USDA Soil Survey Investigation Report No. 1. Maximum particle size, 3/4-inch, with 3 percent retained on 1/4-inch screen. Soluble salts shall not exceed 600 ppm. Meeting ADOT&PF standard specification section 726.

B. Approved alternative to topsoil is Biotic Soil and Erosion Control by Profile, ProGanics DUAL. This is a biodegradable composition of wood and bark fibers mixed (sanitized to eliminate weed seeds and pathogens), fortified with wetting agents, crosslinked biopolymers, water absorbents, regenerated plants and beneficial bacteria to promote vegetative establishment.

2.02 SEED

A. Grass Seed: Grasses of the type specified shall met the applicable requirements as outlined by the State of Alaska Department of Natural Resources, Division of Agriculture, “Seed Regulations,” latest edition.

B. Grass Seed shall also meet DOT&PF standard specification section 724-2.02.

C. Seed Species: Seed shall meet or exceed the percentages of purity and germination as specified below:

1. Sun and Partial Shade: Proportioned by weight as follows:

a. Disturbed Areas:

Proportion	Name	Min. % Germ.	Min. % Pure Seed	Max. % Weed Seed
30%	Nugget Bluegrass	80	85	0.50
30%	Red Fescue	85	98	0.50
40%	Smooth Brome	80	75	1.00

2.03 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 20 percent phosphorus, and 10 percent potassium, by weight.

B. Fertilizer shall also meet DOT&PF standard specification section 725-2.02.

PART 3 - EXECUTION

3.01 TOPSOIL

A. Spread 4 inches uniformly over subgrade in lawn or other areas to be seeded.

B. For Biotic Soil and Erosion topsoil alternative must achieve 99% ground coverage. Follow manufacturer's installation instructions.

3.02 SEEDING

A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 2 lbs./1,000 sq. ft.

C. Apply fertilizer uniformly spread over seeded area at rate of 10 lbs./1,000 sq. ft.

D. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Topsoil and Seeding: measured using the limits shown on the plans and specified in the written authorization for the work issued on-site by the Engineer to compute the in-place per square yard.

4.02 BASIS OF PAYMENT

A. Payment for landscaping by the Contractor shall include furnishing all necessary personnel, equipment, transportation, and supplies to perform the work as shown and specified.

B. Landscape work is included in other respective bid items, except as specifically provided for herein or elsewhere in these specifications.

Pay Item No.	Pay Item	Pay Unit
329200-1	Topsoil	Square Yards
329200-2	Seeding	Square Yards

END OF SECTION

SECTION 330523.13 – HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The Work under this section includes supplying all equipment, materials and qualified personnel, and performing all tasks necessary for the installation of pipe materials as specified utilizing the technique of Horizontal Directional Drilling (HDD) at the locations and elevations shown on the project plans in a manner acceptable to the Engineer.

B. This Section includes casings and related components for crossing State of Alaska Department of Transportation & Public Facilities (DOT&PF) property.

C. References:

1. American Society for Testing and Materials (ASTM):

    a. ASTM D638 – Standard Test Method for Tensile Properties of Properties.
    b. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

2. Project Specifications:

    a. Section 013300 “Submittal Procedures.”
    b. Section 335000 “Casings.”

1.03 CONTRACTOR QUALIFICATIONS

A. Construction of pipe by the horizontally drilled, directionally controlled method shall be performed only by a qualified contractor or subcontractor and personnel. The Contractor or subcontractor performing the work as an entity, and the resident supervisor(s) to be in responsible charge of the HDD work shall each have a minimum of five (5) years of experience in horizontal directional drilling. In addition, the resident supervisor(s) shall have successfully completed a minimum of three (3) directionally drilled pipe installations of 12-inch or greater diameter pipes, each with a length in excess of 300 feet.

1.04 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.05 CONTRACTOR SUBMITTALS

A. Furnish Submittals in accordance with Section 013300 “Submittal Procedures” and the following supplemental requirements.

B. In accordance with instructions to proposers, submit contractor, subcontractor, and supervisor qualifications to complete directional drilling with bid proposal for project. Qualification submittal shall include:

1. Names, addresses, phone numbers and work history for all supervisory personnel to be directly involved with the project and present on the project throughout the HDD construction substantiating the individual’s qualifications to perform the required work. Include a list of experience projects for the individual with the following information:
2. Name of the project.
3. Project location.
4. Date of Completion.
5. Owner.
6. Owners Representative and phone number.
7. Description of HDD work, include size and length of pipe, soil conditions, and equipment used.
8. Specific responsibility of individual named in the resumes.

C. At least one week prior to scheduled work submit complete methodology, specific to each crossing, including:

1. Drawing of work site, including location and footprints of equipment, pipe layout area, the locations of the entry, exit pits, pipe assembly area, fencing
2. Equipment specifications and capabilities.
3. Size of pilot hole.
4. Number and size of pre-reams.
5. Use of rollers, baskets and side booms to suspend and direct pipe during pull back.
6. Type and capabilities of the drill head tracking system.
7. The number of sections in which the product is to be installed
8. Minimum pipe elevation.
9. Entry and exit angle of pipeline.
10. Bending radii of the pipeline.
11. Weak link type and capabilities.
12. Anticipated subsoil conditions and contingency plan for dealing with varied soil condition.

D. Schedule of work including mobilization, drilling the pilot hole, reaming passes, pipe assembly, pipe pullback, clean up and demobilization.

E. Drawing of work site, including location and footprints of equipment, pipe layout area, the locations of the entry, exit and slurry containment pits, pipe assembly area, fencing.

F. Drilling fluid management plan, including drilling fluid containment, recycling/transport and approved disposal site.

G. Emergency procedures for inadvertently boring into a live power line, natural gas line, water line, sewer line, or fiber-optic cables. Procedures must comply with regulations.

H. Environmental Monitoring Plan including method of dealing with inadvertent returns, surface seepage of drilling fluids and spoils, and “frac-outs”.

I. At least two (2) weeks prior to commencing work submit data from the manufacturer regarding the tensile strength and recommended minimum bending radius of the pipe.

J. The Engineer will review submittals and must approve prior to beginning work.

K. Within four (4) days of completing the directional drilling installation for each run of pipe, provide the log of the drilling operation and guidance system records documenting the line and grade of that installed pipe on increments no more than 10 feet.

1.06 EQUIPMENT

A. The Contractor shall be responsible for the directional drilling method and equipment. The drilling machine shall be suitable in all regards for the purpose of installing the size, length, and pipe materials specified to the locations and elevations shown on the plans through all types of soil materials that may be encountered, including but not limited to sand, gravel, silt, rock, and debris all of which may be saturated with water or frozen.

B. Contractor shall use a rotary drilling machine with steerable drilling head purpose designed for HDD installation of pipe. The drilling machine shall have a minimum of 70,000 lb manufacturer rated pullback capability, and a maximum drill string bend radius of no greater than 500 feet.

C. Operating range and degree of accuracy of the proposed tracking system shall be adequate to meet project conditions. Tracking/steering equipment shall allow for continuous monitoring of the drilling head along the entire proposed alignment. The monitoring equipment and drilling machine control systems shall be capable of locating and placing the pipe within a tolerance of plus or minus 1-foot in both the horizontal and vertical planes. If a poor contact with the sonde is expected to occur at any section, this shall be communicated to the Engineer prior to commencement of construction.

D. The drilling unit must be equipped with an electrical strike safety package. The package shall include warning sound alarm, grounding mats and protective gear.

E. Provide load cell for monitoring of pipe tension during pullback operations.

1.07 PRE-COMMENCEMENT

A. Notify owners of subsurface utilities along and on either side of the proposed drill path of the impending work through the one-call program. All utilities along and on either side of the proposed drill path are to be located. Not all utilities participate in one-call and it is the Contractor’s responsibility to coordinate with all utilities present.

B. All utility crossings shall be exposed using hydro-excavation, hand excavation or another approved method to confirm depth.

C. The proposed drill path shall be determined and documented, including its horizontal and vertical alignments and the location of buried utilities and substructures along the path.

D. Excavation for entrance and exit pits are to be of sufficient size to avoid a sudden radius change of the pipe, and consequently, excessive damage.

1.08 REGULATORY REQUIREMENTS

A. The Contractor shall perform all work in accordance with the laws and regulations of the State of Alaska.

B. The Contractor shall abide by all regulatory agency restrictions/requirements, including those of the Alaska Department of Fish and Game, US Army Corps of Engineers, and DOT&PF.

1.09 CONSTRUCTION AREA

A. Contractor shall complete all construction activities including staging of materials and equipment and stringing together pipe, within the designated public right-of-way or within the acquired temporary construction easements provided for the purpose.

1.10 GEOTECHNICAL INFORMATION

A. Geotechnical borings are available for reference as indicated in Supplementary Conditions. These borings represent general conditions across the project area and should not be assumed to represent exact subsurface conditions at horizontal directional drilling sites. Contractor is responsible for obtaining additional geotechnical information that they deem necessary to identify localized frozen soils, muck, and groundwater information.

PART 2 - PRODUCTS

2.01 DRILLING FLUID

A. The Contractor is to ensure that the drilling fluids and chemicals that have the potential to come into contact with the ground are biodegradable, safe to water bodies and fire resistant.

2.02 HIGH DENSITY POLYETHYLENE PLASTIC PIPING (HDPE) AND FITTINGS

A. Pipe and fittings shall conform to AWWA C901 and AWWA C906.

B. HDPE Pipe shall meet the following: Manufactured from PE4710 polyethylene compounds that meet or exceed ASTM D3350, cell classification of PE445574; Standard Dimension Ratio (SDR) of 17, and a minimum working pressure of 200 psi; all pipe shall have the same trade (brand) name and shall be certified by the manufacturer as compatible for fusion joining.

C. Pipe Joints: Join HDPE pipe and fittings using butt-fusion and/or electrofusion couplings. Butt-fusion shall be in accordance with ASTM D3261. Electrofusion couplings shall comply with ASTM F1055.

2.03 BALL MARKERS

A. Electronic Ball Marker shall contain a passive-tuned antenna, molded inside a plastic disk. Shell of marker must be impervious to minerals, chemicals and temperature extremes. 3M Scotchmark 1403-XR Electronic Ball Marker for water utilities and 1404 XR Electronic Ball Marker for wastewater utilities, or equal, compatible with 3M marker locator.

1. Ball Marker Colors: Blue: Water systems.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE

A. A cone shall be fabricated and attached to the pulling head that will protect the leading edge of the arctic pipe insulation. This is a jacketed, large diameter pipe. Ream bore hole, and provide pulling equipment to degree needed to install pipe without jacket damage.

B. A shield shall be fit around the pulling head that prevents cobbles from wedging between the drill string and pipe.

C. Drill path shall not deviate more than 2 feet horizontally and/or 1 foot vertically at any point from the designed alignment without preapproval by the Engineer. If the drill path deviates outside these stated tolerances, the Engineer, at the Engineer's discretion, can request that a new bore hole be drilled at no additional cost to the Owner.

D. Desired end points for the HDD boring are as shown on the Drawings. The pilot hole entry point shall be as close as practical to the specified location. The exit point shall be within 2 feet horizontally and 1 foot vertically from the specified exit point. If the pilot hole bore fails to arrive within the stated parameters, the Engineer, at the Engineer's discretion, can request that a new pilot bore hole be drilled at no additional cost to the Owner. The Contractor shall stake this point in the field using experienced surveying personnel.

E. Tracking readings of the drilling head shall be marked at least every 10 feet for review by the Engineer.

F. Drill only in areas shown on Drawings or where preapproved by Engineer.

G. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.

H. Contractor is responsible for providing proper equipment to be used for lifting and placing pipe.

I. Pipe to be installed to the required alignment shown in the Drawings

J. Monitor tension loads during pipe pullback, do not exceed manufactures recommended load limits on pipe. Assist pipe into entry hole (push and pull operations) as needed to limit tensile loads.

K. Every precaution shall be taken to prevent foreign material from entering the pipe.

L. When pipe laying is not in progress, the open end of the pipe must be closed to the satisfaction of the Engineer.

M. Securely attach at least two tracing wires to the pulling head prior to pullback.

3.02 GENERAL

A. Only trained operators shall be permitted to operate the drilling equipment and manufacturer's operating instructions and safety practices shall always be followed.

B. Drilling mud pressure in the borehole shall not exceed that which can be supported by the overburden to prevent heaving or hydraulic fracturing of the soil ("Frac-out").

C. Entrance and exit angles of the drill string shall be as per the submitted methodology. Any deviation from these values shall first be approved by the Engineer.

D. If a drilled hole must be abandoned, the hole shall be filled with grout or bentonite to prevent future subsidence.

E. Pipe installation shall be performed in a manner that prevents over-stressing and straining of the pipe.

1. A section of pipe at least one nominal diameter size smaller than the carrier pipe shall be connected between the pulling head and the carrier pipe to prevent over- stressing to carrier pipe. The maximum tensile strength of weak-link shall not exceed the recommend pull-back force of the carrier pipe.
2. Torsional Stress: A swivel connection shall be employed between the product pipe and the reamer (and back reamer, if applicable) to eliminate torsional stress on the product pipe.
3. Buckling Stress: The Contractor shall fill the underground portion of the pipe with potable water, during pullback to prevent buckling and reduce buoyancy.

F. If the pipe becomes stuck in the drill hole during pullback such that it cannot be successfully pulled into place without exceeding the manufacturers allowable tensile stress and strain, and cannot be recovered in whole or in part, Contractor shall seal the pipe and existing drill hole and repeat efforts to achieve a successful drill beginning with a new pilot hole. Contractor shall bear all costs connected with supplying replacement pipe string as required and installing it in accordance with the plans and specifications.

3.03 DRILLING

A. Drilling mud shall be used during drilling and back-reaming operations.

B. A sufficient number of proof pre-reams shall be utilized to avoid heaving while enlarging the hole to the desired diameter.

C. During pull-back, the conduit must be sealed at either end with a cap or plug to prevent water, drilling fluids and other foreign materials from entering the pipe as it is being pulled back.

D. Pipe rollers, skates or other protective devices shall be used.

E. It is desirable for the product pipeline to be welded into one string prior to commencement of the pullback operation, so as to enable an uninterrupted installation.

F. The pilot hole shall be back-reamed to accommodate and permit free sliding of the product inside the borehole. Back-ream diameter shall be 1.5 times the OD of the carrier pipe.

3.04 DRILLING FLUIDS – COLLECTION AND DISPOSAL PRACTICES

A. Excess drilling mud slurry shall be contained in a tank at exit and entry points until recycled or removed from the site. Entrance and exit tanks shall be of sufficient size to contain the return of drilling mud and spoils.

B. When working in an area of contaminated ground, the slurry shall be tested for contamination and disposed of in a manner that meets government requirements.

C. Precautions shall be taken to keep drilling fluids out of the streets, manholes, sanitary and storm sewers and other drainage systems, including streams, rivers, and lakes.

D. Recycling drilling fluids is an acceptable alternative to disposal.

E. The Contractor shall make all diligent efforts to minimize the amount of drilling fluids and cuttings spilled during the drilling operation, and shall provide complete clean-up of all drilling mud overflow or spills.

F. The Contractor shall dispose of all recovered drilling fluid and cuttings at a disposal site provided by the Contractor. Drilling fluid and cuttings shall not be disposed of or otherwise buried on site.

3.05 CLEANUP, MATERIAL DISPOSAL AND WORK

A. Disposal of any material into sloughs and drainages is strictly prohibited.

B. Disposal of drilling fluids into the City and Borough of Yakutat sewer system is strictly prohibited.

C. The Contractor shall have available at the site containment equipment, such as silt fencing, pumps, geotextiles, etc., necessary to contain any inadvertent release of drilling fluid to the environment. The containment equipment shall be onsite at all times when work is ongoing.

D. The Contractor shall be aware that the Owner may implement a monitoring program to monitor water quality in adjacent water bodies.

E. Burying of rubbish and waste onsite shall not be permitted.

F. Disposal of waste or volatile materials into waterways or storm or sanitary sewers shall not be permitted.

G. Pumping or draining water containing silt in suspension into waterways, sewers or drainage systems is prohibited.

H. Abide by requirements of statute, bylaws, and regulations respecting disposal of wastes.

I. All waste materials shall be removed and disposed by the Contractor at a disposal site located by the Contractor and approved by the Engineer. Obtain required permits for waste disposal. Provide copies to the Owner. The work area shall be organized and cleaned at the end of each working day.

J. The Contractor shall maintain the site and surrounding properties in as clean a condition as possible during execution of the Work.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Horizontal Directional Drilling: Horizontal Directional Drilling pipe shall be measured by the installed length in the field and shall include all joints and other such items necessary for joining.

1. All drilling, excavation and disposal, bedding, markers, backfill materials and placement, and traffic control shall be subsidiary to installed cost of pipe.
2. All pavement patching and any other restoration shall be subsidiary to the installed cost of the pipe.

4.02 BASIS OF PAYMENT

A. Payment for approved quantities of utilities casing as measured above shall be at the contract unit price per installed item.

Pay Item No.	Pay Item	Pay Unit
330523-1	Horizontal Directional Drilling 8”	Linear Foot
330523-2	Horizontal Directional Drilling 12”	Linear Foot
330523-3	Horizontal Directional Drilling 18”	Linear Foot

END OF SECTION

SECTION 331100 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes water-distribution piping and related components for combined water service.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Training Certificate for Heat Fusion of HDPE Pipe. This shall be in accordance with ASTM F2620 and the Plastic Pipe Institute PPI TR-33. Training shall comply with the Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects- PPI -TN-42.

1.05 DEFINITIONS

A. Water Main: Exterior water piping that supplies water to services and fire hydrants.

B. Water Service: Exterior domestic-water piping that connects structures to the water main.

1.06 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.
   1. Hydrostatic pressure test results.
   2. Disinfection and biological test results.
   3. Joint fusion procedures and records. Copies of the data logger information and drawing showing locations shall be submitted to the inspector for review and recordation purposes before final approval of the job. Each weld/fusion on the pipe and fittings during Construction is to be labeled and marked with a contrasting permanent color marker detailing: Company name, fusion technician’s initials or stamp in the bead, date of the fusion and construction project number, and joint number to correspond with the fusion data log record and picture of fusion.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and hydrants to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of CBY water utility. Include tapping of water mains and backflow prevention.
   2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
   3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

D. NSF/ANSI Compliance: Comply with NSF/ANSI 61 for materials for water mains, service piping and specialties for domestic water.

E. Lead-Free: All materials that come into contact with potable water shall have a low lead content, not containing more than 0.2 percent lead when used with respect to solder and flux and not have more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt service to facilities occupied by the CBY or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated if the water service disruption lasts for more than 10 hours:

1.11 COORDINATION

A. Coordinate connection to water main with CBY.

PART 2 - PRODUCTS

2.01 PE PIPE AND FITTINGS

A. PE, Pipe: AWWA C906, DR No. 11; with PE compound of PE4710 high density polyethylene meeting ASTM D 3350 cell classification 345464C and shall be listed in the name of the pipe manufacturer in PPI (Plastic Pipe Institute) TR-4 with a standard grade HDB rating of 1600 psi at 73 degrees. Permanent identification of piping shall be provided by co-extruding multiple equally spaced color strips into the pipe outside surface or by solid colored pipe shell. Blue for potable water.

B. PE, Fittings: Shall be butt fused unless transitioning to Ductile Iron.
   1. Molded Fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be marked
   2. Fabricated Fittings shall be made by heat fusion joining specially machined shapes out from pipe, polyethylene sheet stock or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe. Fabricated fittings shall be tested in accordance with AWWA C906.
   3. Polyethylene Flange Adapters. Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion–joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serration) to promote gasketless sealing, or restrain the gasket against blowout.
   4. Back-up Rings & Flange Bolts. Flange adapters shall be fitted with back-up rings that are pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 3 or higher.
   5. MJ Adapter. MJ Adapter 4” through 16” may be provided with option Stainless Steel Stiffner upon request.

2.02 DUCTILE IRON PIPE

A. Push-On-Joint, Ductile-Iron Pipe: AWWA C151, Class 50, with push-on-joint bell and plain spigot end unless flanged ends are indicated. Cement lining shall conform to AWWA C104.
   1. Gaskets: AWWA C111, nitrile rubber, US Pipe Field LOK 350 or equivalent.

B. Mechanical Joint Ductile Iron Fittings: AWWA C153, ductile-iron standard pattern. The fittings shall have a minimum rating of 150 PSI working pressure but be capable of withstanding three times the rated water working pressure as per AWWA C110 and C153. Interior of fittings, cement mortar lined per AWWA C104.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile-iron glands, nitrile rubber gaskets, and steel bolts.
2. Restrained Joint: Provide field installed wedge action joint restraint for all AWWA C110 and C153 mechanical joint fittings (Meg A Lug by EBAA Iron or approved equal).

C. For DIP through HDD casings use US Pipe TR Flex or equal.

2.03 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
1. Fittings: Brass flared type. Flared fittings for use with flared copper tube for cold water applications with a maximum water pressure of 175 psig, manufactured to the requirements of ANSI/ASME B16.26, “Cast Copper Alloy Fittings for Flared Copper Tubes.”

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2.04 POLYETHYLENE ENCASEMENT

A. Encasement for Underground Ductile Iron Piping:
1. Standards: AWWA C105/A21.5.
2. Form: Tube.
3. Material: Linear Low Density Polyethylene (LLDPE) film of 8-mil minimum thickness.
4. Color: Black.

2.05 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
1. Nonrising-Stem, Resilient-Seated Gate Valves: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and 2-inch stem nut.
a. Standard: AWWA C509.
b. Minimum Pressure Rating: 200 psig.
c. End Connections: Mechanical joint.
d. Interior Coating: Epoxy-lined, complying with AWWA C550.
e. Equipped with name or symbol, size, year of manufacture, and working pressure cast into body.

B. Bronze Gate Valves:
1. Nonrising-Stem Gate Valves: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
a. Standard: MSS SP-80.

2.06 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering

"WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.07 SERVICE LINE CHECK VALVES

A. AWWA Check Valves: Bronze horizontal swing-check renewable seat, Y-pattern.
   1. Standard: MSS SP-80.
   2. Pressure Rating: 175 psig.

2.08 CORPORATION VALVES

A. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
   1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
   2. Corporation Stop: The corporation stop shall comply with AWWA C800 and consist of a bronze body cast to a ground-key plug valve. The corporation stop shall be designed to provide fully closed to fully open operation with one quarter turn. Corporation stops shall be manufactured by Ford Meter Corporation.
      a. Copper water service branch tail section shall consist of a threaded female flare fitting nut which provides connection to a threaded tail and which is suitable for use with the copper service piping.

2.09 WATER SERVICE METERS

A. Water Meters - Displacement Type:
   1. Manufacturer: Subject to compliance with requirements by utility company, as indicated on Drawings or engineer approved alternative.
   2. Source Limitations: Obtain water meters - displacement type, from single manufacturer.
   3. Standard: AWWA C700.
   4. Pressure Rating: 150 psig working pressure.
   5. Body Design: Nutating disc; totalization meter.
   6. Registration: Flow in **gal.** as required by utility company.
   7. Case: Bronze.
   8. End Connections: Threaded.

2.10 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:
   1. Manufacturer: Mueller Co.
   2. Description: Mueller Super Centurion 250 with one NPS 4-1/2-inch front-facing outlet and two NPS 2-1/2-inch side outlets, 5-1/4-inch main valve, drain valve, and NPS 6 flanged-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast or ductile iron body, compression-type valve opening against pressure and closing with pressure.
      a. Standard: AWWA C502.
      b. Pressure Rating: 250 psig.
      c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
f. Exterior Finish: Factory painted, yellow alkyd-gloss enamel paint.

2.11 BOLLARDS

A. Schedule 40 Steel Pipe: Paint shall be yellow alkyd-gloss enamel.

2.12 BALL MARKERS

A. Electronic Ball Marker shall contain a passive-tuned antenna, molded inside a plastic disk. Shell of marker must be impervious to minerals, chemicals, and temperature extremes. 3M Scotchmark 1403-XR Electronic Ball Marker for water utilities and 1404 XR Electronic Ball Marker for wastewater utilities, or equal, compatible with 3M marker locator.
1. Ball Marker Colors: Blue: Water systems.

2.13 RE-CIRC CHECK VALVE

A. In-line rubber duckbill type check valve with flanged joint, NSF-61 approved. Proco Series 700 ProFlex, or equal. Rated for 125 psig.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping except at fire hydrants.

D. Underground Water-Service Piping:
1. Soft copper tube, ASTM B 88, Type K copper, pressure-seal fittings; and pressure-sealed joints.
2. Ductile-iron, push-on-joint pipe, mechanical-joint fittings, and ductile-iron-pipe appurtenances.

E. Aboveground Water-Service Piping Inside Homes: Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings.

F. Underground Main Piping: Ductile-iron, push-on-joint pipe, mechanical-joint fittings, and ductile-iron-pipe appurtenances. Or Butt-Fused HDPE.

3.03 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for underground installation. Use mechanical by flanged-end valves for installation at fire hydrants only.

3.04 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for isolation of water main at connection points.

B. Install ductile-iron, water piping according to AWWA C600 and AWWA M41.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

C. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

D. Bury piping with minimum depth of cover over top as shown in Standard Drawings or as shown in Project Drawings.

E. Install underground piping with restrained joints. At horizontal and vertical changes in direction, use mechanical fittings with restraint.

3.05 JOINT CONSTRUCTION

A. Make pipe joints according to the following:
   1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
   2. HDPE- Joints between plain end pipes and fittings shall be made by butt fusion. External and internal beads shall not be removed from the pipe.

3.06 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Field-lock gaskets.
   2. Concrete thrust blocks.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints only at fire hydrants.

3.07 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Corporation Valves/Pitorifices: Install each underground curb valve with head pointed up.

3.08 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to manufacturer’s instructions.

3.09 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water-distribution piping to the CBY's water main. Install fittings and valves shown in drawings.

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 150 psig for two hours. Test in accordance with ANSI/AWWA C600.

C. Prepare reports of testing activities and submit to Engineer of Record.

3.12 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

3.13 CLEANING AND DISINFECTING

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure described in AWWA C651.

B. Prepare reports of purging and disinfecting activities and submit to Engineer of Record.

C. Disposal of flushing water shall be the responsibility of the Contractor. Removal of this water shall not cause damage to property or inhibit the flow of vehicular traffic in or around the work area. The Contractor is responsible for obtaining ADEC permit if required.

D. Contractor is required to provide backflow prevention during flushing and disinfection process to protect existing water mains from becoming contaminated.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Water Main: Measurement will be along the horizontal projection of the pipe from center to center of angle points.

B. Fire Hydrants: Hydrants shall be measured on a per each basis in place including all material and installation from water main.

C. Gate Valves: Gate valves shall be measured on a per each basis in place.

D. Water Services: Shall be measured on a per each basis. Estimated lengths and sizes are shown on the drawings.

E. Pump house will not be measured since this is a lump sum item.

4.02 BASIS OF PAYMENT

A. Payment for Water Distribution items by the Contractor shall include furnishing all necessary material, personnel, equipment, transportation, excavation, bedding, and backfill up to existing grade, and supplies to perform the work as shown and specified. Bollards shall be subsidiary to the fire hydrant pay item. Excess soil material shall be hauled from the site, and this shall be subsidiary.

B. Payment for pipe and fittings installed and other buried assemblies or work, will not be paid until trench excavation, bedding, backfill, and all testing are finished and the work is complete in place.

C. Payment for Contractor-Furnished Water Main will not be paid until the pipe is furnished, transported, insulated, and installed.

D. Payment for water services includes service saddles, corporation stops or valves, copper tubing or ductile iron as specified in service schedule, penetrations into the building, and all appurtenances inside the building. Improvements on the property that are removed such as but not limited to walkways, planters, and fences, shall be restored subsidiary to this pay item. Seeding and driveway improvements shall be paid for under respective bid items.

E. Payment for piping includes subbase and base course to rebuild the road. However, asphalt, and gravel resurfacing are separate pay items.

F. Payment for the pump house shall include work shown on civil, structural, mechanical, electrical and control sheets.

Pay Item No.	Pay Item	Pay Unit
331100-1	6” HDPE Water Main	Linear Foot
331100-2	10” HDPE Water Main	Linear Foot
331100-3	6” Ductile Iron Water Main	Linear Foot
331100-4	10” Ductile Iron Water Main	Linear Foot
331100-5	3” Recirculation Line	Linear Foot
331100-6	Fire Hydrants	Each
331100-7	6” Gate Valves	Each
331100-8	10” Gate Valves	Each
331100-9	Water Services	Each
331100-10	Pump House	Lump Sum

END OF SECTION

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SECTION 331613 – POTABLE WATER STORAGE TANK, BOLTED STEEL CONSTRUCTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section includes furnishing and erecting the bolted steel reservoir and necessary piping and appurtenances, per AWWA D103-19 specifications, (latest revision).

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.05 DEFINITIONS

A. Water Tank: Exterior standalone bolted steel potable water storage tank, prefabricated and assembled onsite.

1.06 INFORMATIONAL SUBMITTALS

A. Qualifications of Tank Supplier:

1. The Engineer’s selection of a factory applied epoxy-coated bolt together tank is predicated on a thorough examination of design criteria, construction methods, and optimum coating for resistance to internal and external tank corrosion. Deviations from the specified design, construction or coating details will not be permitted.
2. The bidder shall offer a new tank reservoir as supplied from a manufacturer specializing in the design, fabrication and erection of bolted water storage tanks.
3. The tank shown on the contract drawings and specified herein shall be fabricated by CST Industries, One Clarion or approved equal.
4. Tank design shall be stamped by a licensed engineer in the State of Alaska.
5. The tank vendor’s engineer is responsible for verifying that the provided foundation design is adequate to support the final tank loads and reactions. The contractor shall include in their budget an allowance for up to 15% additional concrete and reinforcing steel beyond the quantities shown in the drawings, to accommodate any modifications required based on the final tank reactions.
6. Erection of the tank is to be by the tank manufacturer or approved contractor. The installer shall be fully responsible for the entire installation including tank erection, and

the ultimate water tightness of the complete installation. The tank manufacturer shall monitor and inspect work performed by the approved contractor.

7. Strict adherence to the standards of design, fabrication, erection, product, quality, and long-term performance, established in this Specification will be required by the Owner and Engineer.

B. Submittal Drawings and Specifications:

1. Construction shall be governed by the Owner's drawings and specifications showing general dimensions and construction details. Drawings shall include insulation system and penetration details. There shall be no deviation from the drawings and specifications, except upon written order from the Engineer.
2. The bidder is required to furnish, for the approval of the Engineer and at no increase in contract price, five (5) sets of complete specifications and construction drawings for all work not shown in complete detail on the bidding drawings. A complete set of structural calculations shall be provided for the tank structure. The tank foundation will be designed and constructed by others.
3. When approved, two sets of such prints and submittal information will be returned to the bidder marked "APPROVED FOR CONSTRUCTION" and these drawings will then govern the work detailed thereon. The approval by the Engineer of the tank supplier's drawings shall be an approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detail dimensions and quantities, which remains the bidder's responsibility.

C. Field Quality-Control Test Reports:

1. Hydrostatic pressure test results.
2. Disinfection and biological test results.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Operational instructions for water valves and meters to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

A. Steel, piping, and appurtenance materials shall bear label, stamp, or other markings of specified testing agency.

B. NSF/ANSI Compliance: Comply with NSF/ANSI 61 for materials for water piping for domestic water.

C. AWWA Compliance: Comply with AWWA Standard D103-19.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare prefabricated steel tank components to preclude from damage incurred during transport.

B. Protect stored steel framing, plate, and piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

C. Protect flanges, fittings, and specialties from moisture and dirt.

1.10 COORDINATION

A. Coordinate tank construction laydown requirements and schedule with the General Contractor responsible for construction of the Pump house Site.

1.11 TANK CAPACITY AND ELEVATION

A. Tank working capacity shall be 500,000 U.S. gallons (nominal). See drawings for operating points as well as nominal height and diameter.

B. Freeboard space at the top of tank shall be 6.5 feet.

1.12 TANK DESIGN REQUIREMENTS

A. Design Standards: The materials, design, fabrication and erection of the bolted tank shall conform to:

1. AWWA Standard D103-19, (latest edition).

2. ANSI/NSF Standard No. 61

B. Tank Foundation: The tank vendor's engineer is responsible for verifying that the provided foundation design is adequate to support the final tank loads and reactions. The contractor shall include in their budget an allowance for up to 15% additional concrete and reinforcing steel beyond the quantities shown in the drawings, to accommodate any modifications required based on the final tank reactions.

1. Tank floor shall slope up inwardly at 0.01 ft/ft (minimum).

C. Reservoir shall be furnished with piping and appurtenances as shown on the plans and as follows:

1. Inlet pipe.
2. Overflow pipe.
3. Outlet pipe.
4. Drain pipe.
5. 30-inch square, hinged, lockable roof hatch.
6. Two shell manholes with hinged covers.
7. Outside ladder with ladder gate and lock, without fall protection.
8. Screened roof vent.
9. Level indicator.
10. Identification nameplate.
11. Tank mixer.
12. Power appurtenances.
13. Communications appurtenances.

D. Cathodic Protection: Active system required to be designed by tank manufacturer.

E. Corrosion Allowance: No corrosion allowance (additional plate thickness) is required on any plate steel.

F. Structural Requirements: All tank structural components to be designed per the requirements of AWWA D103-19 and API Spec 12B.

1. Seismic Design Criteria at Tank Site:

S_S	= 1.63
S_1	= 0.76
I_e	= 1.5
Site Class	= D

2. Roof Design Criteria:

Balanced roof snow load	= 188 pounds per square foot (PSF)
P_g	= 186
I_s	= 1.2
C_e	= 1.0
C_t	= 1.2

3. Wind Design Criteria:

a. Wind Speed = 161 mph, pressures to be the maximum of ASCE 07-16 and AWWA D103-19.

4. Foundation: Shallow frost-protected mat foundation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. All materials shall meet “Buy American” meeting Federal Acquisition Regulations (FAR).

2.02 TANK MATERIALS

A. All tank materials shall be in accordance with all applicable standards of AWWA D103-19, Section 4.

2.03 VALVE APPLICATIONS

A. Tank Application: Use flanged-end valves for all aboveground tank piping.

2.04 COATINGS

A. Interior Coating System:

1. All coatings that are in contact with potable water must be certified on the current approved list of the National Sanitation Foundation to meet ANSI/NSF Standard No. 61, as well as AWWA D103-19.
2. Coating system, including coating manufacturer brand name to be as specified in bid documents.
3. Interior coating process shall conform to AWWA D102-17 ICS-6 and shall include:

a. Shop epoxy-prime.
b. Field spot epoxy prime.
c. Apply epoxy finish.

B. Exterior Coating System:

1. Exterior coating system, including coating manufacturer brand name, and average dry film thickness/mils (DFT) to be as specified in bid documents.
2. All exposed edges will be coated with primer. Underside of floor will remain uncoated.
3. Exterior coating process shall include:

a. Shop epoxy-prime.
b. Field spot epoxy prime.
c. Apply epoxy intermediate coating.
d. Apply epoxy finish coat.

2.05 TANK FABRICATION

A. All reservoir sub-assemblies and accessories, including shell manholes, ladders, and overflow pipes, shall be fabricated in accordance with AWWA D103-19, Sec. 7 Accessories for Tanks.

B. All exterior ladders, guard rails, brackets, hatch covers, pins and fasteners shall be steel that is hot dipped galvanized per ASTM A123/153 after fabrication.

C. Welded steel deck assembly per AWWA D103-19.

D. Roof construction per AWWA D103-19.

2.06 APPURTENANCES

A. Pipe Connections:

1. Overflow piping shall be 6-inch nominal diameter Schedule 80 carbon steel coated externally.
2. Inlet and outlet connections shall conform to the sizes and locations specified on the plan sheets.
3. Provide and install all internal tank piping as flanged spool pieces that facilitate free passage through roof opening and assembly inside tank.

B. Insulation Blanket

1. Provide and install removable insulation blankets at all valves and expansion joints.
2. Provide and install removable insulation blanket covers for exterior drain and overflow piping.
3. Blankets shall be made with 4 inches of mineral-wool or fiberglass blanket insulation, sewn in grey siliconized fabric, with stainless steel lacing anchors, fabricated to be well-fitting and to close easily around equipment without air gaps or exposed surfaces. Use stainless steel tie wire for securing blankets.
   a. Insulation shall be mineral-wool or fiberglass insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Outside Tank Ladders:

1. An outside tank ladder shall be furnished and installed as shown on the Drawings.
2. Safety cage and step-off platforms shall be fabricated of galvanized steel. Ladders shall be equipped with hinged lockable entry devices.

D. Access Doors:

1. Two hinged manways shall be provided as shown on the contract drawings in accordance with AWWA D103-19.
2. The manhole opening shall be a minimum of 30 inches in diameter. The access door (shell manway) and the tank shell reinforcing shall comply with AWWA D103-19.

E. Roof Vent:

1. A properly sized vent assembly in accordance with AWWA D103-19 shall be furnished and installed above the maximum water level of sufficient capacity as shown on the drawings.
2. The overflow pipe shall not be considered to be a tank vent.
3. Provide tank vent stick-up elevation from tank roof as shown on the Drawings.
4. The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including a 4 mesh (1/4-inch opening size) galvanized screen. If required by the contract drawings, a 16 mesh (1/16-inch opening size) galvanized screen will be installed to prevent the entrance of insects.

F. Roof Hatch: The manufacturer shall furnish a roof opening which shall be placed in line between the outside tank ladder and tank vent and which shall be provided with a hinged cover and a hasp for locking. The opening shall have a clear dimension of at least 30 inches square. The opening shall have a curb, at least 4 inches high and the cover shall have a downward overlap of at least 2 inches.

1. Roof hatch shall be sized to allow tank mixer to freely pass through the opening.

G. Roof Perimeter Guardrail: Perimeter guardrail and toe board around the perimeter of the deck shall be provided and installed as shown on the Drawings.

H. Liquid Level Indicator: A liquid level indicator with stainless steel float, numbered board and high visibility target shall be provided and installed as detailed on the project drawings.

I. Identification Plate: Manufacturer’s nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall location approximately 5 feet from the grade elevation.

1. Nameplate mounting steel shall allow 5 inches clear space from shell to accommodate insulation panels.

J. Electrical Appurtenances: Provide supporting struts and brackets, conduit entry boots, cable entry fittings, and other fittings, complete with corrosion resistant straps, fasteners and other hardware, as required, for supporting electrical equipment, and support and entry of electrical cable and conduit, as indicated in the plans.

1. All electrical materials and installations, installed in the tank interior, shall meet the applicable requirements of Articles 2.04 and 2.06 of this specification section.
2. Struts and brackets shall be components of a mounting system, with compatible conduit straps and other required attachments, of a common manufacturer, suitable for mounting electrical raceway and equipment.
3. Struts and brackets shall be mounted to the tank with welded studs, or with mounting flanges directly welded to the tank interior and exterior, prior to applying final interior coatings and exterior insulation system.

4. Attach struts for support of conduit and cable, at specific locations and spacing, in accordance with Article 300 of the NEC.
5. Supporting struts mounted to the exterior of the tank, shall extend a minimum of one-foot outside of the tank insulation system to stand-off and support electrical raceway and exterior mounted equipment.
6. Apply coatings to supporting struts, brackets, conduit straps and other associated fittings and attachments, mounted in the tank interior, in accordance with applicable requirements of Article 2.04 of this specification section.
7. Provide a cord-grip fitting, at each cable entry into top of tank, with annulus of rubber grommet sized to match outside cable diameter.
8. Provide weathertight, weatherproof, flexible conduit entry boot fitting, for the entrance of each conduit entry through the top of the tank.

    a. Body of entry boot fitting shall be a one-piece rubber extrusion, that includes sealing flange that mates to tank surface, and flexible boot that forms an annulus seal, or gland, around the conduit.
    b. Entry boot shall be provided as a kit, complete with corrosion resistant metallic tank mating flange, clamp(s), and attachment hardware.
    c. Entry boots shall be flexible, permitting angled conduit entries up to 15 degrees off of perpendicular centerline, in any direction, without leaking or subjecting the conduit or conduit seal to excessive stress.
    d. Installed entry boot, with installed conduit, shall withstand a minimum of 6 feet of water head pressure, at maximum conduit entry angle, without leakage.

K. All ladder mounts, nozzles, and manway flanges shall be positioned to provide adequate distance from the shell to allow for stud removal and maintenance without conflict with tank insulation system.

L. Personal Fall Arrest System: Provide and install a fixed ladder fall arrest anchor and self-retracting lifeline. CAI Safety Systems SRL Fall Arrest Anchor or approved equal.

M. Tank Mixer: Provide and install tank mixer where indicated in the Drawings per manufacturer’s recommendations. Tank mixer shall be PAX PMW150 or approved equal.

2.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water piping to the Pump House. Install fittings and valves shown in drawings.

C. Install pre-insulated pipe and fittings per manufacturer’s specifications.

PART 3 - EXECUTION

3.01 EARTHWORK

A. All excavation, structural fill, and structural backfill in connection with foundation preparation and construction shall be completed by others according to the requirements of the drawings and of contract documents. A finished foundation will be provided for constructing the tank, in advance of the tank manufacturer’s planned starting date.

B. All trench excavation, pipe laying, and pipe bedding and backfill shall be done according to the requirements of the drawings and specifications.

3.02 CONCRETE

A. All concrete work for the reservoir foundation shall be provided based on Specifications in Section 033000 – Cast-in-Place Concrete.

3.03 FIELD QUALITY CONTROL

A. Tank fabricator shall field verify the foundation elevation and the tolerances of the in-place foundation. Any deviations shall be reported to the Engineer for correction before proceeding with any work. All tank piping must be in place prior to the commencement of tank erection.

3.04 TANK ERECTION

A. The CONTRACTOR shall furnish all labor, tools, scaffolding, and other equipment necessary to properly erect the tank complete and ready for use.

B. Erection shall be completed in compliance with Section 10 of AWWA D103-19 for bolted steel tanks.

3.05 FIELD QUALITY CONTROL TESTING

A. After the erection of the reservoir is completed, it shall be tested for leaks. Any leaks that are disclosed in the shell bottom, roof, manhole, or piping shall be repaired.

B. Inspection and testing shall be in accordance with Section 11 of AWWA D103-19, (latest revision).

C. Make available all radiographs and other testing information to the Owner's Representative during construction.

D. After completion of the work, the Contractor shall submit a written report and certification that all work has been inspected and tested and is in accordance with all applicable provisions of AWWA D103-19, (latest revision).

E. All costs associated with testing shall be paid by the Contractor.

F. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks or field foam insulation have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

1. Hydrostatic Tests: Test pipe at not less than 150 psig for two hours.
2. Prepare reports of testing activities and submit to Engineer of Record.

3.06 STANDARDS

A. The tank structure shall be disinfected at the time of testing in accordance with AWWA Standard C652-02 "Disinfection of Water Storage Facilities" using chlorination method No. 2. Disinfection shall be performed by a competent water treatment contractor.

3.07 TANK MANUFACTURER'S WARRANTY

A. The tank manufacturer shall include a warranty on tank materials and workmanship for a specified period. As a minimum, the warranty shall provide assurance against defects in material, coatings and workmanship for a period of one (1) year.

B. Upon completion of the 1-year warranty period provide an inspection of the tank coating. The City's preference is for a submersible camera with a video that they can observe. Provide two copies of the video; one to the City and one to the RESPEC Engineers.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

A. Construction of the Potable Water Storage Tank and associated items by the Contractor shall include furnishing all necessary material, personnel, equipment, transportation, up to final grade, and supplies to perform the work as shown and specified.

B. Payment for the Potable Water Storage Tank, pipe and fittings will not be paid until all testing are finished and the work is complete in place.

C. Payment for the Potable Water Storage Tank shall include work shown on civil, structural, mechanical, and electrical sheets.

Pay Item No.	Pay Item	Pay Unit
331613-1	500K Gallon Water Storage Tank	Lump Sum

END OF SECTION

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SECTION 333113 – SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Agreement, including General Provisions of Contract, General and Supplementary Conditions and Division 01 General Requirements apply to the work of this Section.

1.02 SUMMARY

A. This section includes sanitary sewer piping, and leach field to be installed at the pump house.

1.03 RELATED SECTIONS

A. Division 31 Section “Site Clearing.”

B. Division 31 Section “Earth Moving” for excavation and backfill.

1.04 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

1.05 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.06 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 specification sections.

B. Product Data: Submit manufacturer's technical product data and installation instructions for sewage system materials and products, including but not limited to all piping, pipe joints, fittings, and leach field materials.

1.07 QUALITY ASSURANCE

A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage systems.

B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary sewage system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.

C. Compliance of Materials: All materials used on this project shall be new, unused and of current manufacture. Evidence of compliance with these specifications shall be furnished by the Contractor, before construction begins.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe fittings and seals from dirt and damage.

B. Handle manholes and other structures according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.01 SEWER MAIN PIPE AND PIPE FITTINGS

A. Pipe and fittings shall conform to AWWA C901 and AWWA C906

B. HDPE Pipe shall meet the following: Manufactured from PE4710 polyethylene compounds that meet or exceed ASTM D3350, cell classification of PE445574; Standard Dimension Ratio (SDR) of 17; all pipe shall have the same trade (brand) name and shall be certified by the manufacturer as compatible for fusion joining.

C. HDPE Fittings: Provide fittings of at least the same pressure rating, manufactured from the same polyethylene compounds, and having the same ASTM D3350 cell classification as the adjoining pipe. Molded fittings and specials shall be used to the extent that they are available from the pipe manufacturer. When molded fittings are not available, factory -produced mitered fittings shall be used. Fabricate by using butt fusing or sidewall fusing per ASTM D2657. Construct fabricated bends 30 degrees and less with at least two segments. For 45-degree to 90-degree bends, provide at least three segments. For a 90-degree bend, provide at least five segments. Field-fabricated fittings are prohibited.

D. Pipe Joints: Join HDPE pipe and fittings using butt-fusion and/or electrofusion couplings. Butt-fusion shall be in accordance with ASTM D3261. Electrofusion couplings shall comply with ASTM F1055.

2.02 LEACH FIELD PIPE AND FITTINGS

A. HDPE Pipe and Fittings: SDR 17 meeting ASTM D3035. Fittings may be fused or bell and spigot.

B. Perforated Pipe:

1. 4-Inch PVC Leach Pipe Distribution Laterals and Fittings: ASTM D2665. Pipe shall be smooth-wall, bell and spigot ends. Leach pipe shall have two (2) 5/8-inch holes spaced at 120-degree intervals with no more than 5-inch spacing in between perforations.

C. Monitor Tube/Cleanouts: 4-inch ABS meeting ASTM D2661, Schedule 40

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section “Earth Moving.”

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping

layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at elevation and slope indicated on Drawings.

3.03 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section “Earth Moving.” Arrange for installation of green warning tapes directly over piping and at outside edges of underground structures.

3.04 INSTALLATION, GENERAL

A. Lay Piping: Beginning at low point of system, true to grades and alignment indicated.

1. Placing Pipe: Contour compacted bedding to accept pipe barrel, provide depressed area to accept bell ends, "haunch" or hand tamp the bedding around the pipe to achieve good support.
2. Cleaning Pipe: Clear interior of piping of dirt and other superfluous material as work progresses.
3. Place plugs in ends of uncompleted conduit at end of day or whenever work stops. Secure plug such that it cannot be forced into the pipe.
4. Final accuracy of all installed piping, except that installed in casing, shall be within 0.01 foot vertically and 0.05 foot horizontally of the exact location taken from the plans. In no case will a reverse or flat grade be allowed. Pipe which exceeds the above limits of variation shall be adjusted immediately and no further pipe shall be laid until so authorized by the Owner’s Representative.

3.05 BACKFILLING

A. Backfilling is specified in Division 31 Section “Earth Moving.”

3.06 FIELD QUALITY CONTROL

A. Hydrostatic Test:

1. Test sanitary sewerage according to the following:

a. 6 feet above the upper end of the test section shall be maintained for a period of 4 hours, during which time it will be presumed that full absorption of the pipe body has taken place and thereafter for a further period of 1 hour for the actual test of leakage.

b. During this 1-hour period, the measured loss shall not exceed the rate given in the following formula (which shall also apply to ground water infiltration):

E = 0.002 x D x L, where

E = allowable leakage in gallons per hour
D = nominal diameter of the pipe in inches
L = length of pipe being tested

2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.07 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Leach Field will not be measured for payment. It is subsidiary to the Pump House.

4.02 BASIS OF PAYMENT

A. Payment for Septic System, and Leach Field, items shall include furnishing all necessary personnel, equipment, transportation and supplies to perform the work as shown and specified.

END OF SECTION

SECTION 334100 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Pipe and fittings.

1.03 DEFINITIONS

A. Drainage Piping: System of culvert pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.04 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.06 INFORMATIONAL SUBMITTALS

A. Record Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between piping and other structures.

B. Field quality-control reports.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

1.08 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by CBY or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify private land owners and the CBY no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without CBY’s written permission.

PART 2 - PRODUCTS

2.01 PIPES AND PIPE FITTINGS

A. Culvert: Corrugated steel pipe (CSP), ASTM A 760/A 760M, Type I, made from ASTM A 444/ A 444M, zinc-coated steel sheet for banded joints. All seams on pipes manufactured with helical corrugations shall have a continuous weld extending from end to end of each length of pipe in conformance with AASHTO M 36.

1. Corrugated steel pipe, coupling bands, and flared end sections shall conform to AASHTO M-26 and AASHTO M-218. All culvert pipe shall be 16-gauge, minimum.
2. Fittings: Fabricated to types indicated and according to same standards as pipe.
3. Connecting Bands: Standard couplings made for corrugated-steel pipe to form soiltight joints.

    a. Coupling bands shall be one piece recorrugated to annular two valleys minimum per end.
    b. Band angles shall be 2 inches by 2 inches by 12 GA minimum. Band material and fabrication shall be per AASHTO M 36 and AASHTO M 218. Band material shall be equal to, or one standard gauge size less than, the gauge of the corrugated pipe being banded.
    c. Dimpled type connecting bands shall be allowed only where fittings are used for repairs to damaged CSP and for extensions to CSP without annular ends.

4. Metal End Sections: Metal end section shall conform to Alaska Department of Transportation Standard Detail Drawing D-06.01 included with this Section. Metal end sections shall be installed to match what is existing.

5. Marker Posts: Marker Posts shall conform to Alaska Department of Transportation Standard Detail Drawing D-09.00.

B. Corrugated polyethylene pipe (CPP) shall conform to AASHTO M 294, Type S.
1. Polyethylene pipe couplings shall be corrugated to match the pipe corrugations, and their width shall be no less than one-half of the nominal pipe diameter.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 INSTALLATION, GENERAL

A. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

B. Handling: All pipe and materials shall be delivered and distributed at the site by the Contractor. Pipe, fittings, specials and accessories shall be loaded and unloaded by lifting with hoists and pipe slings or skidded to avoid shock or damage. Pipe shall not be handled by inserting an object into the barrel and lifting. In no case shall materials be dropped. Pipe handled on skids shall not be skidded or rolled against pipe already on the ground.

1. Pipe and accessories shall be handled so that coatings and linings will not be damaged. If, however, any part of the coating or lining is damaged, it shall be repaired by the contractor, at no additional expense to the Developer, and to the satisfaction of the Engineer of Record.

C. Lay piping true to grades and alignment indicated.

1. Placing Pipe: Contour compacted bedding to accept pipe barrel, hand tamp the bedding around the pipe to achieve good support.
2. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations.
3. Cleaning Pipe: Clear interior of piping of dirt and other superfluous material as work progresses.
4. Final accuracy of all installed piping shall be within 0.01 foot vertically and 0.10 foot horizontally of the exact location taken from the plans. In no case will a reverse grade be allowed. Pipe which exceeds the above limits of variation shall be adjusted immediately.

D. Culvert Marker Posts.

1. Install culvert marker posts at all impacted culverts crossing ADOT & PF within project limits.

3.03 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. Corrugated Steel Pipe: Join and install according to ASTM A 798.

B. Corrugated Polyethylene Pipe: Install on the water main with joints centered on the sanitary sewer main at the crossing.

3.04 BACKFILLING IS SPECIFIED IN SECTION 312000, EARTH MOVING.

A. General: Conduct backfilling operations of open-cut trenches closely following laying and joining, and after initial inspection is completed.

1. See traffic control plan “Project Specific Notes” for additional restrictions.

3.05 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 12 inches of backfill is in place, and again at completion of the Project.

1. Defects requiring correction include crushed, broken, cracked, or otherwise damaged piping.

3.06 DRAINAGE SYSTEM ACCEPTANCE

A. Field Quality Control: Field densities shall be taken on each culvert installation; one density at the spring line of pipe and one per each foot of trench backfill above the top of pipe.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Corrugated Steel Pipe: Corrugated Steel Pipe shall be measured along the horizontal projection of the pipe from end to end of the culvert.

B. Metal End Section: End sections shall be measured on a per each basis in place.

C. Culvert Marker Post: Culvert Marker Posts shall be measured on a per each basis in place.

D. Corrugated Polyethylene Pipe: Corrugated Polyethylene Pipe (Casing) shall be measured by the installed length in the field and shall include all joints and other such items necessary for joining.

4.02 BASIS OF PAYMENT

A. Payment for storm drainage by the Contractor shall include furnishing all necessary personnel, equipment, transportation and supplies to perform the work as shown and specified.

B. Payment for culverts, fittings, and casings installed, trench excavation, or work, will not be paid until backfill and all testing are finished and the work is complete in place.

Pay Item No.	Pay Item	Pay Unit
334100-1	18” Corrugated Steel Pipe	Linear Foot
334100-2	18” Culvert End Section	Each
334100-3	24” Corrugated Steel Pipe	Linear Foot
334100-4	24” Culvert End Section	Each
334100-5	36” Corrugated Steel Pipe	Linear Foot
334100-6	36” Culvert End Section	Each
334100-7	60” Corrugated Steel Pipe	Linear Foot
334100-8	60” Culvert End Section	Each
334100-9	Culvert Marker Post	Each
334100-10	18” Corrugated Polyethylene Pipe	Linear Foot

END OF SECTION

SECTION 400500 - BASIC REQUIREMENTS FOR PROCESS MECHANICAL

PART 1 - GENERAL

1.01 GENERAL

A. All provisions of the Contract Documents apply to the work of this Division.

B. All Division 40 Sections are subject to the provisions of this Section.

1.02 SUMMARY OF WORK

A. Work Included: Provide all labor, materials, equipment, and incidental items necessary for completely finished and operational mechanical systems. Examine documents of other trades for any additional work which may be required of the Mechanical Contractor.

1.03 DEFINITIONS

A. Exposed: Exposed in mechanical rooms or rooms with finished walls or ceilings.

B. Concealed: Located in pipe chases, furred spaces, attics, crawl spaces above suspended ceilings or all other locations not exposed to view.

1.04 DIVISION OF RESPONSIBILITY

A. Specification formatting which indicates a division in the mechanical work is for convenience only. It is not intended to delineate lines of responsibility between subcontractors and/or suppliers. Such delineation rests entirely with the contractor.

1.06 PLANS AND SPECIFICATIONS

A. Plans are diagrammatic. They indicate general intent, design and arrangement of systems. Provide all minor incidentals such as offsets, fittings, etc., as may be required even though not shown. Do not scale the plans; take dimensions from actual field conditions.

B. Specifications establish quality of materials/equipment, manufacturing details, and installation particulars.

1.07 CODES, REGULATIONS

A. Conform to codes and regulations applicable at the project site.

B. Call for inspections from local authorities as required.

C. If discrepancies occur between contract documents and local regulations, the more stringent requirement applies.

1.08 FEES, PERMITS

A. Obtain required permits.

B. Pay permit fees, construction fees, inspection fees.

1.09 COORDINATION

A. Coordinate with other trades to ensure orderly progress of the work and to ensure proper fit in confined spaces.

B. Coordinate utility interruptions with the Owner and/or the Utility Company.

C. Report to the General Contractor any construction defects which affect the mechanical work; proceed with mechanical work only after defects have been corrected.

D. Prepare coordinated shop drawings at 3/8" scale. Use these drawings for fabrication and installation. Do not use the Contract Drawings as shop drawings.

1.10 QUALITY ASSURANCE

A. Perform work in accordance with good trade practice and in a neat manner. Comply with Project Engineer's direction concerning finished appearance.

B. Adhere to manufacturers' recommendations.

1.11 PROTECTION

A. Of People: Arrange barriers, signs, etc. as required to minimize the hazard to people. Comply with applicable safety and health regulations.

B. Of Work: Take all measures necessary to protect the work both before and after installation, to ensure that it will be in clean, undamaged, unblemished condition when turned over to the Owner. Repair/replace work damaged during construction.

1.12 SUBMITTALS

A. Submit product data and/or shop drawings for:

1. All items scheduled on the Contract Drawings.

2. Any items specifically called for in other Sections.

B. Submit samples of any items specifically called for in other Sections.

C. Submit through General Contractor to Project Engineer. Do not submit directly to Engineer. Include at least one additional copy above the requirements of Division 1.

1.13 SUBSTITUTIONS

A. Basis of design is indicated by make and model.

B. Other manufacturers desiring acceptance to bid must submit for prior approval. See Division 1 for procedure.

C. For all listings of acceptable substitute makes, the phrase "or equal" is implied unless specifically indicated otherwise.

D. If makes other than that used as the basis of design are utilized, be responsible for space requirements, configuration, performance, suitability, architectural and structural changes, etc., resulting from substitution.

1.14 ENGINEERING INSPECTION

A. Notify Project Engineer to inspect:

1. All work under test.
2. All work prior to concealment.
3. All equipment prior to start-up.

4. All work prior to Owner's acceptance (i.e.: "Final Inspection").

B. A "Final Inspection" punch list will be issued outlining work for correction/completion. When all punch list items have been rectified, signify same by initialing each line item in the appropriate space provided on the punch list. Return the initialed list to the Engineer who will verify same. The cost of any engineering inspections required after this point will be back charged to the Mechanical Contractor.

1.15 RECORD DOCUMENTS

A. Maintain at Job Site: Contract documents, reviewed submittals, field test records.

B. As-Built Drawings: Neatly revise the design drawings to reflect the as-built condition. Dimensionally locate site utilities and underslab work. Identify major valves in accordance with valve tag list. Deliver as-built drawings to Project Engineer at project completion.

1.16 OPERATING & MAINTENANCE MANUAL

A. Format: 8-1/2" x 11" loose-leaf hard cover, permanently labeled. All contents typed or neatly lettered.

B. Contents: Each section set off by index tabs. Include:

1. Table of Contents.

2. Executed Warranties.

3. Name, address and telephone number of installing contractors and subcontractors, along with brief description of their project responsibility.

4. Name, address and telephone number of material and equipment suppliers, along with listing of items supplied.

5. Brief narrative on each system including:

   a. System description.

   b. System start, operation, shutdown procedures.

   c. Emergency procedures for fire, failure, etc.

   d. Preventive maintenance program including cleaning, replacement, adjustment, lubrication schedules.

6. Equipment tabs arranged in the same order as the spec, to include for all equipment supplied:

   a. Reviewed submittals.

   b. Installation instructions.

   c. Operating instructions.

   d. Maintenance instructions.

   e. Parts lists.

7. Temperature control system tab to include the same information as the equipment tabs. Diagrams should reflect the as-built condition.

8. Balance report.

9. Valve tag list.

10. Certificates of Inspection

C. At project completion submit one copy of manual to Engineer for review. Make any corrections required. Transmit three corrected copies to General Contractor for delivery to Owner.

1.17 WARRANTIES

A. Provide warranty addressed to Owner. Extend warranty for one year from date of acceptance.

B. Provide extended warranty for equipment requiring same.

C. Include executed warranties in Operating & Maintenance Manuals.

D. During warranty period provide labor and materials to repair or replace defects. Pay for damage to other work resulting from defects.

E. See Division 1 from additional requirements.

1.18 KEYS & SPARE PARTS

A. At project completion transmit to General Contractor for delivery to Owner.

1.19 DEMONSTRATIONS

A. Conduct demonstrations when systems are complete and operational and ready to be turned over to the owner, and after the Operating and Maintenance Manual is complete.

B. Instruct the Owner's representative, in the presence of the Project Engineer or Engineer, on the proper operation and maintenance of the mechanical systems. Perform this instruction at the project site, using the Operating and Maintenance Manual as a guide. Continue instruction until the Owner's representative is comfortable with his knowledge and understanding of the systems.

C. Pay particular attention to normal and emergency start-up and shut-down procedures, seasonal change-over, safety devices, and temperature control systems.

D. For subjects in which the Contractor may not be personally qualified to offer complete comprehensive instruction, secure the services of one who is.

1.20 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 400507 - HANGERS AND SUPPORTS FOR PROCESS PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes Steel pipe hangers and supports.

B. The requirements of this section apply to the installation of pipe supports, sheet metal ductwork supports, and equipment installations throughout the project.

C. Large diameter pipe support locations and types are shown on the drawings. The contractor shall retain a qualified professional engineer to perform the final design of pipe support systems based on the contractor's approved pipe shop drawings. All pipe supports shall be designed, fabricated, and installed in accordance with the project specifications and applicable codes.

1.02 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 REFERENCES

A. American Concrete Institute (ACI)

B. ACI 318-02 - Building Code Requirements for Structural Concrete and Commentary

C. International Building Code (IBC)

D. IBC-2003 - International Building Code

E. American Society of Mechanical Engineers (ASME)

F. ASME B31.1 - Power Piping Code

G. Manufacturers’ Standardization Society of Valve and Fittings Industry, Inc. (MSS)

1. MSS SP-69 - Pipe Hangers and Supports - Selection and Application

H. Comply with SMACNA “Seismic Restraint Manual Guidelines for Mechanical Systems, “2nd edition, February 1998

1.04 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports
4. Welding certificates

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

1.07 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.

2. Bergen-Power Pipe Supports
3. B-Line Systems, Inc.; a division of Cooper Industries
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

PART 3 – EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified 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 padded hangers for piping that is subject to scratching.

F. Use Stainless Steel (304) in areas that are directly exposed to wastewater or other corrosive gases (i.e. wet wells, sludge basins, chemical storage rooms, etc.)

G. 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. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

H. 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 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

I. 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.

J. 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. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

K. 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:

1. Light (MSS Type 31): 750 lb.
2. Medium (MSS Type 32): 1500 lb.
3. Heavy (MSS Type 33): 3000 lb.
4. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
5. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. 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.

M. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

1. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
2. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel 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 building structure.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

C. 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.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. 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.

F. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

H. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
2. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
3. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
4. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
5. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
6. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

I. Shield Dimensions for Pipe: Not less than the following:

1. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
2. NPS 4: 12 inches long and 0.06 inch thick.

J. Insert Material: Length at least as long as protective shield.

K. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.04 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 400520 - PIPE AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers plant (Interior) piping systems, fittings, pipe support systems, and installation requirements.

B. Related Work:

1. Section 400551, Plant Valves

1.02 SUBMITTALS

A. Certification: Submit manufacturer's certification that products meet requirements of referenced specifications, in accordance with Section 013300.

B. Submit drawings and data showing details of joints, gasket material and pipe length, in accordance with Section 013300.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Ship and stack pipe in accordance with manufacture's recommendations.

B. Do not drop or damage pipe through impact.

C. Ship and store rubber gaskets in cartons away from grease, oil, sunlight, and ozone producing motors.

D. Store pipe on a flat surface which provides even support for the barrel with bell ends overlapping.

E. Do not stack pipe higher than 5 feet.

F. Use only nylon protected slings or bands to handle pipe. Do not use hooks or bare cables.

1.04 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 – PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile Iron Pipe

1. Ductile iron pipe shall be manufactured in accordance with standards ANSI 21.51 (AWWA C-151). Cement mortar lining and bituminous coatings shall conform to ANSI 21.4 AWWA C-104).
2. Ductile iron pipe shall be as specified on the drawings.
3. Protective coating shall be bituminous and 1 mil thick.
4. Joints shall be flanged ductile iron pipe shall conform to ANSI A21.15 (AWWA C115), flat faced unless specified otherwise in the drawings.

2.02 DUCTILE IRON FITTINGS

A. Cement Mortar Lining, ANSI A21.4 (AWWA C-104):

B. Ductile Iron Fittings

1. Mechanical Joints: 250 PSI, ANSI A21.53/AWWA C153; Gaskets, ANSI A21.11/AWWA 111.
2. Flanged Joints: 250 PSI, ANSI A21.10/AWWA C-110; Drilling, ASA-- B16.1, Class 125.

C. Ductile Couplings

1. Mechanical compression sleeve.
2. Dresser Style 38 or approved equal.

PART 3 – EXECUTION

3.01 GENERAL

A. Do not install cracked, chipped, dented, abraded, or otherwise defective pipe.

B. Install in accordance with manufacturer’s recommendations.

3.02 CUTTING PIPE

A. Ductile Iron Pipe

1. Cut pipe smooth using saws or abrasive wheels.
2. Pipe shall be cut at right angles to the pipe axis or angles as needed to properly seat in fittings.
3. Do not damage coating or lining by cutting.
4. Use flanged joints unless otherwise noted

3.03 JOINT INSTALLATION FOR DUCTILE IRON PIPE

A. Flanged Joints:

1. Extend pipe completely through screwed-on flanges.
2. Machine finish the pipe and end flange face in a single operation.
3. Eliminate any restraints on the pipe which would prevent uniform gasket compression or cause unnecessary stress in the flanges.
4. Do not assemble mechanical connections until all flanged joints affected thereby have been tightened.
5. Alternately tighten bolts spaced on opposite sides of the pipe to ensure uniform gasket compression.
6. Holes in flanges shall straddle the top (or side for vertical piping) centerline.

B. Mechanical Couplings (where specified):

1. Clean and smooth pipe ends.
2. 1/4 inch to less than one inch space between pipe ends.

C. Mechanical Joints (where specified):

1. Clean the inside of the bell and outside of spigot such that both are free of oil, dirt or other foreign material.
2. Insert the plain end completely into the bell end and block the fitting into place until the joint is completed.
3. Tighten nuts alternating opposite sides of pipe to ensure even pressure on the retainer gland.
4. Use a torque limiting wrench and do not exceed the following maximum torque valves:

Bolt Size (Dia.)	Torque (ft.-lbs.)
5/8	75
3/4	85

5. Holes in mechanical joint bells shall straddle the top (or side for vertical piping) centerline.

3.04 INSPECTION

A. Examine the pipe and fittings for cracks, dents, abrasions, or other flaws prior to installation.

B. Mark rejected pipe and remove from site.

END OF SECTION

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SECTION 400551 - PLANT VALVES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers plant (Interior) valves and miscellaneous appurtenances. Furnish and install valves and miscellaneous appurtenances complete with all accessories, bolts and gaskets which are shown on the manufacturer's drawings, are specified herein, or are otherwise required for proper installation and functioning of the system.

B. Related Work:

1. Section 400520 – Pipe and Fittings

1.02 SUBMITTALS

A. Submit complete drawings and product data covering valves and appurtenances in accordance with Section 013300.

B. Submit manufacturer's certification that products meet the reference standards in accordance with Section 013300.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Do not damage materials during delivery or storage.

B. Store valves off the ground and away from materials that could contaminate potable water systems.

C. Keep joints and internal parts clean.

1.04 CERTIFICATION

A. All plant valves shall be NSF/ANSI 61 and NSF/ANSI 372 certified.

1.05 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   1. American Iron and Steel (AIS)
   2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 – PRODUCTS

2.01 GATE VALVES (3" SIZE AND LARGER)

A. Resilient seat gate valve manufactured in accordance with AWWA C-509.

B. Stem Seal-O-Ring.

C. Joints as specified.

D. Hand-wheel operator unless otherwise specified in the drawings.

2.02 GATE VALVES (SMALLER THAN 3")

A. Bronze Valves 85-5-5-5: ASTM B62.

B. Joints shall have NPT threaded connections.

C. Handwheel operator unless otherwise specified in the drawings.

2.03 BUTTERFLY VALVES

A. AWWA Style Valves. Valves shall comply to the latest revision of AWWA C504, Short Body Pattern, unless otherwise noted.

B. Hand-lever operator unless otherwise specified in the drawings.

C. Manufacturers:

1. DeZurik
2. Nibco
3. Bray Valves
4. Approved Equal.

2.04 BALL VALVES

A. Ball valves shall be lead-free bronze, full port style valve with hand-lever operator unless otherwise specified in the drawings.

B. Manufacturers:

1. Nibco
2. Apollo
3. Approved Equal.

2.05 CHECK VALVES

A. AWWA Style Valves. Valves shall comply to the latest revision of AWWA C508.

B. Manufacturers:

1. G.A. Industries, Inc., 250 D with renewable bronze seat.
2. American Darling, 52 SC.
3. Mueller, "Detector Gravity."
4. Cla-Val
5. Val-matic

C. 150 psi working pressure related. Valves shall be swing check valves unless otherwise noted.

2.06 AIR RELEASE AND COMBO AIR RELEASE-VACUUM VALVES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Clow
2. Apco
3. Crispin
4. Flomatic

B. Valves shall be air release, or a combination air release and vacuum valve as specified on the drawings.

C. Valves shall be equipped with large orifices for the re-entry and escape of air during draining and filling. Valves shall also be equipped with a small orifice to allow the escape of accumulated air during normal operation.

D. Valves shall have cast or ductile iron bodies.

E. Floats shall be stainless steel or other non-corrodible material.

F. Valves shall have a minimum operating pressure of 150 psi.

G. Valve size shall be as shown on the drawings.

2.07 PRESSURE REDUCING VALVES (PRV) (2” SIZE AND LARGER)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cla-Val.
2. Zurn.
3. Watts
4. Approved Equal

B. PRV shall have 150 lb flanged ends in accordance with ANSI B16.42.

2.08 PRESSURE SUSTAINING/REDUCING VALVES (PSV) (2” SIZE AND LARGER)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cla-Val.
2. Zurn.
3. Watts
4. Approved Equal

B. PRV shall have 150 lb flanged ends in accordance with ANSI B16.42.

2.09 ACTUATED VALVES

A. Flanged ends: 150 lb flanged ends in accordance with ANSI B16.42

B. Fully factory assembled. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action under every condition.

C. Motor: The motor shall be an integral part of the actuator, designed specifically for valve actuator applications. The motor shall be a permanent magnet 24 V dc type with power derived from a 3-phase, 1-phase, or DC supply. The motor shall be a low inertia, high torque design and class H insulated. Gear train shall be totally enclosed in an oil-filled gearcase for operation at any angle. Motors for isolation duty shall be rated for 60 starts/hour. Motors for modulating duty shall be rated for 1,800 starts per hour.

D. Actuator: Direct-coupled type non-hydraulic designed for minimum 100,000 full-stroke cycles at rated torque. Furnish actuator with rating of not less than twice thrust needed for actual valve.

1. Coupling: To match valve connection.
2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
3. Speed Adjustment: Actuator must include a speed adjustment setting to change the motor operating speed.
4. Power Requirements: 208 V ac, 3 phase.
5. Control Power Requirements: 24 V dc.
6. Inputs/Outputs: One (1) analog input (4-20 mA) for position control; One (1) analog output (4-20 mA) for position feedback.
7. Ambient Temperature: Minus 22 to 140 deg F.
8. Size actuator for torque required for valve to close off at maximum differential pressure, regardless of water loop system pressures.
9. Fail-Safe Operation: Actuators with designated fail position shall be supplied with integral shutdown battery with sealed battery pack. Battery pack shall be housed inside actuator body and shall facilitate actuation of valve to fail close position on loss of power. Battery capacity shall be suitable for a minimum of two (2) full valve stroke operations.
10. Handwheel: Provide handwheel for emergency operation, engaged when the motor is declutched by a lever or similar means. The drive shall be restored to electrical operation automatically by starting the motor. The handwheel or selection lever must not move on restoration of motor drive.
11. Local Controls: The actuator must incorporate integral local controls for Open/Close operation and include a Local/Stop/Remote mode selector switch.

E. Acceptable actuator manufacturers include: Rotork or approved equal.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine the valves and appurtenances for cracks, flaws or other defects. Remove all defective valves and appurtenances from the site. Repair or replace all damaged coatings.

B. If material is found to be defective by the OWNERS or ENGINEER, the CONTRACTOR shall promptly remove the defective material, whether installed or not, and immediately replace it with acceptable material.

3.02 INSTALLATION

A. Manufacturer's Instructions: Follow the published instructions of the manufacturers of all items covered in this section.

B. Install with valve operator plumb and vertical. Provide anchor ties were determined by ENGINEER or shown by plans.

C. Install all gaskets per manufacturer's recommendations and referenced standards. Torque bolts in accordance with standards and manufacturer's recommendations.

END OF SECTION

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SECTION 400597 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels
2. Warning signs and labels
3. Pipe labels

1.02 SUBMITTAL

A. Product Data: For each type of product indicated.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   a. American Iron and Steel (AIS)
   b. Build America, Buy America Act
B. See Supplementary Conditions for details.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND VALVE LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: 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.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch

bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black

C. Background Color: White

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high

PART 3 – EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT AND VALVE LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment and valves with tags numbering per design drawings.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

B. Pipe Label Color Schedule:

1. Potable Water Piping:
    a. Background Color: White
    b. Letter Color: Black
2. Valves:
    c. Background Color: White
    d. Letter Color: Black
3. Major Equipment:
    e. Background Color: White
    f. Letter Color: Black

3.04 SAMPLE TAP IDENTIFICATION

A. General: Identify all sample taps with tags (raw, treated, finished, potable, etc.)

B. Use: Tags, stamped metal or engraved laminate, with sample tap identification, attached with chain or nylon tie so as not to interfere with tap operation.

C. As-Built Drawings: Show sample tap ID designations thereon.

3.05 TANK/SAFETY SIGNAGE

A. General: Identify all bulk storage tanks; contents, volume, hazards (if any). Identify all safety concerns and personal protective equipment (PPE) requirements.

B. Use: Safety and tank signage material will be selected to provide appropriate surface adhesion (i.e. adhesive vinyl suited to plastic tanks, foam adhesive backing suited to cinder block, aluminum or steel to be fastened with screws, etc). Pressure-sensitive markers/signs, suitable for tank materials and contours.

C. Location, Orientation: Tank signage to be positioned where signage is readily visible on tank sides. Safety- type signage to be located at entrances to specified areas, or adjacent to equipment or hazard.

END OF SECTION

SECTION 406000 - PROCESS CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. PLC-based Process Control System (PCS) for monitoring and control of process equipment related plant process system(s), plant alarming, and monitoring miscellaneous plant support systems. Process Control System shall be complete to meet the performance as described in this specification and related information on the project Contract Drawings and other specifications as noted below.
2. Work to connect the PCS furnished under this project into the City's SCADA network interface point at City Hall. Contractor shall coordinate with the SCADA network administrator and City Hall's IT department to provide all equipment, programming, network configuration, and all other services necessary to ensure secure and functional integration of the PCS with the City's SCADA network.
3. Field instruments for monitoring and control of plant processes:

    a. Pressure Instruments
    b. Temperature Instruments
    c. Flow Instruments
    d. Level Instruments
    e. Chlorine Analyzers
    f. Position Limit Switches
    g. Actuated Valves

4. See attachments for additional performance requirements:

    a. Attachment A: Control Narrative
    b. Attachment B: I/O List

B. Related requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for instrumentation cable, control cable and control circuit conductors.
2. Section 260529 "Hangers and Supports for Electrical Systems" for support requirements.
3. Section 260533.13 "Conduits for Electrical Systems" for raceways for low-voltage control cable.
4. Section 260533.16 "Boxes and Covers for Electrical Systems" for boxes and covers for low-voltage control cable.
5. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for construction of underground control cable raceways.
6. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" for sleeves and sleeve seals for control raceways.

7. Section 260553 “Identification for Electrical Systems” for general raceway and wire identification.
8. Section 270528 "Pathways for Communications Systems" for raceways for balanced twisted pair cabling.
9. Section 271513 "Communications Copper Horizontal Cabling" for balanced twisted pair communications cable.
10. Section 400551 “Plant Valves” for electrically actuated valves used for process control.
11. Section 407113 “Magnetic Flow Meter” for electromagnetic flow meters.
12. Section 407521 “Chlorine Analyzer” for chlorine analyzers.

1.02 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. Binary: Two-state signal where a high signal level represents ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

D. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.

E. COV: Changes of value.

F. E/P: Voltage to pneumatic.

G. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

H. HLC: Heavy load conditions.

I. KVM: Keyboard, video, mouse.

J. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

K. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

L. Modbus TCP/IP: An open protocol for exchange of process data.

M. MS/TP: Master-slave/token-passing, ISO/IEC/IEEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

N. MTBF: Mean time between failures.

O. PCS: Process control system.

P. PLC: Programmable logic controller.

Q. PLC System Provider: Authorized representative of, and trained by, PLC system manufacturer and responsible for execution of PLC system Work indicated.

R. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI) and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

S. I/P: Current to pneumatic.

T. LAN: Local area network.

U. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

V. POT: Portable operator's terminal.

W. RAM: Random access memory.

X. Router: Device connecting two or more networks at network layer.

Y. SCADA: Supervisory Controls and Data Acquisition.

Z. Server: Computer used to maintain system configuration, historical and programming database.

AA. TCP/IP: Transport control protocol/Internet protocol.

BB. UPS: Uninterruptible power supply.

CC. USB: Universal Serial Bus.

DD. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

1.03 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

A. Multiple Submissions:

1. If multiple submissions are required to execute work within schedule, first submit a coordinated schedule clearly defining intent of multiple submissions. Include a proposed date of each submission with a detailed description of submittal content to be included in each submission.
2. Clearly identify each submittal requirement indicated and in which submission the information will be provided.
3. Include an updated schedule in each subsequent submission with changes highlighted to easily track the changes made to previous submitted schedule.

B. Product Data

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation, and maintenance instructions including factors affecting performance.
5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.

    a. PLC controllers and I/O modules.
    b. Operator interface terminals.
    c. Gateways.
    d. Routers.
    e. Enclosures.
    f. Electrical power devices.
    g. UPS units.
    h. Instruments.
    i. Control valves and actuators
    j. Accessories.

6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.

C. Software Submittal:

1. Cross-referenced listing of software to be loaded on each operator workstation, server, and PLC controller.
2. Description and technical data of all software provided and cross-referenced to products in which software will be installed.

3. Operating system software, operator interface and programming software, color graphic software, PLC controller software, maintenance management software, and third-party software.
4. Include a flow diagram and an outline of each subroutine that indicates each program variable name and units of measure.
5. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

D. Shop Drawings:

1. Shop drawings shall be stamped by a Certified Automation Professional or registered Alaska Professional Engineer in either Control Systems or Electrical discipline.

2. General Requirements:

   a. Include cover drawing with Project name, location, Owner, Architect, Contractor, and issue date with each Shop Drawings submission.
   b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
   c. Drawings Size: 11 inches x 17 inches.

3. Include plans, elevations, sections, and mounting details where applicable.
4. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
5. Detail means of vibration isolation and show attachments to rotating equipment.
6. Control panel drawings indicating the following:

   a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
   b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates, and allocated spare space.
   c. Front, rear, and side elevations and nameplate legend.
   d. Unique drawing for each panel.

7. PCS system electrical power riser diagram indicating the following:

   a. Each point of connection to field power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
   b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
   c. Each product requiring power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
   d. Power wiring type and size, race type, and size for each.

8. Monitoring and control signal diagrams indicating the following:

   a. Control signal cable and wiring between controllers and I/O.

b. Point-to-point schematic wiring diagrams for each product.

9. Color graphics for HMI screens indicating the following:

a. Itemized list of HMI color graphic displays to be provided.
b. For each HMI display screen to be provided, a true color copy showing layout of pictures, graphics, and data displayed.
c. Intended operator access between related hierarchical display screens.

E. System Description:

1. Full description of PCS system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
2. Complete listing and description of each report, log and trend for format and timing, and events that initiate generation.
3. System and product operation under each potential failure condition including, but not limited to, the following:

a. Loss of power.
b. Loss of network communication signal.
c. Loss of controller signals to inputs and outpoints.
d. Server failure.
e. Network failure.
f. Controller failure.
g. Instrument failure.
h. Control valve actuator failure.

4. Complete bibliography of documentation and media to be delivered to Owner.
5. Description of testing plans and procedures.
6. Description of Owner training.

F. Delegated Design Submittals: For PCS products and installation indicated as being delegated.

1. Supporting documentation showing PCS design complies with performance requirements indicated, including calculations and other documentation necessary to prove compliance.
2. Schedule and design calculations for control valves and actuators.

a. Flow at Project design and minimum flow conditions.
b. Pressure-differential drop across valve at Project design flow condition.
c. Maximum system pressure-differential drop (pump close-off pressure) across valve at Project minimum flow condition.
d. Design and minimum control valve coefficient with corresponding valve position.
e. Maximum close-off pressure.
f. Leakage flow at maximum system pressure differential.
g. Torque required at worst case condition for sizing actuator.
h. Actuator selection indicating torque provided.
i. Actuator signal to control damper (on, close or modulate).
j. Actuator position on loss of power.
k. Actuator position on loss of control signal.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Statements:

1. Systems Provider's Qualification Data:

a. Resume of project manager assigned to Project.
b. Resumes of application engineering staff assigned to Project.
c. Resumes of installation and programming technicians assigned to Project.
d. Resumes of service technicians assigned to Project.
e. Brief description of past project including physical address and building's primary function.
f. Description of past project PCS system, noting similarities to Project scope and complexity indicated.
g. Names of staff assigned to past project that will also be assigned to execute work of this Project.

2. Manufacturer's qualification data.
3. Testing agency's qualification data.

C. Source Quality-Control Submittals:

1. Source quality-control reports.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

E. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For PCS system.

1. Include the following:

a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, email addresses, and 24-hour telephone numbers of Installer and service representatives for PCS system and products.

e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
f. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
g. Backup copy of graphic files, programs, and databases supplied on electronic media.
h. List of recommended spare parts with part numbers and suppliers.
i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
k. Licenses, guarantees, and warranty documents.
l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
m. Owner training materials.

B. Licensing

1. Licensing for Owner. Entity name to receive the following licenses will be obtained from the Owner.
2. PLC software licensing shall be provided to the Owner for all PLC systems.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials and parts to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Include product manufacturers' recommended parts lists for proper product operation over four-year period following warranty period. Parts list to be indicated for each year.

C. Furnish parts, as indicated by manufacturer's recommended parts list, for product operation during one-year period following warranty period.

D. Furnish quantity indicated of matching product(s) in Project inventory for each unique size and type of following:

1. PLC Controller: One.
2. I/O Card: One of each type.
3. General-Purpose Relay: Two.
4. Multifunction Time-Delay Relays: Two.
5. DC Power Supply: One.

1.08 QUALITY ASSURANCE

A. PCS System Manufacturer Qualifications:

1. Rockwell Automation, no substitutions allowed.
2. Nationally recognized manufacturer of process control systems and products.
3. Process control systems with similar requirements to those indicated for a continuous period of 10 years within time of bid.
4. Process control systems and products that have been successfully tested and in use on at least three past projects.
5. Having complete published catalog literature, installation, operation, and maintenance manuals for all products intended for use.
6. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing, and quality control.
    d. Technical support for process control system installation training, commissioning, and troubleshooting of installations.
    e. Owner operator training.

B. PCS System Provider Qualifications:

1. Authorized representative of, and trained by, PCS system manufacturer.
2. PCS system provider shall maintain a UL 508A certified panel shop or engage the services of a UL 508A certified panel shop for the fabrication of all process control system panels.
3. Demonstrate past experience with installation of process control system products being installed for period within five consecutive years before time of bid.
4. Demonstrate past experience on five projects of similar complexity, scope, and value.
5. Demonstrate past experience of each person assigned to Project.
6. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
7. Service and maintenance staff assigned to support Project during warranty period.
8. Product parts inventory to support ongoing PCS system operation for a period of not less than five years after Substantial Completion.
9. PCS system manufacturer's backing to take over execution of the Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

1.09 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.

a. Install updates only after receiving Owner's written authorization.

3. Warranty service shall commence within 16 hours of Owner's warranty service request.
4. Warranty Period: Two year(s) from date of Substantial Completion.

B. PCS System Maintenance: Provide quarterly maintenance to verify system operations for a period of 1 year. Software upgrades to maintain licensing where not required to address warranty items shall be scheduled with owner written authorization at these times.

PART 2 - PRODUCTS

2.01 PCS/PLC SYSTEM MANUFACTURERS

A. Allen Bradley/Rockwell Automation, no substitutions, including the following base modules:

1. Platform: CompactLogix Platform
2. Processor Module: 1769-L33ER (or current compatible model) with Ethernet communications.
3. Discrete Isolated Input Modules: 1769 class for operation at 24 V dc.
4. Discrete Output Modules: 1769 class or operation at 24 V dc.
5. Analog Input Modules: 1769-IF HART family.
6. Analog Output Modules 1769-OF HART family.
7. Power Supplies: 1769 class for operation at 24 V dc.

B. Size and selection of PCS PLC modules shall allow for expansion within the enclosures.

C. PCS PLC control panel/cabinet shall be certified to UL 508A.

2.02 WEB ACCESS

A. Access to PCS to be web compatible.

1. Web-Compatible Access to PCS System:

a. Workstation to perform overall system supervision and configuration, graphical user interface, management report generation, and alarm annunciation.
b. PCS system to support web browser access to process data. Operator using a standard web browser is able to access control graphics and change adjustable set points.
c. Password-protected web access.

2.03 PERFORMANCE REQUIREMENTS

A. Delegated Design, Qualified Professional: Engage a qualified professional to design PCS system to satisfy requirements indicated.

1. System Performance Objectives:

a. PCS system manages all unit process operations involved with the pump house process, water storage tank monitoring, and pump house balance of plant support systems.
b. PCS system responds to power failures, process equipment failures, and adverse and emergency conditions encountered through connected I/O points.
c. PCS system operates while unattended by an operator and through operator interaction.
d. PCS system records trends and transactions of events and produces report information such as performance, production records, and equipment operation.

B. PCS System Data Storage:

1. Include capability to archive not less than 12 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends, and other information indicated.
2. Local Storage:

a. Provide with data storage indicated. Server(s) to use IT industry standard database platforms and be capable of functions described in "PCS Data Access" Paragraph.

C. PCS Data Access:

1. When logged into the system, operator shall be able to also interact with any PLC controllers connected to PCS system as required for functional operation of PCS system.
2. Use for application configuration; for archiving, reporting, and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.

D. Future Expandability:

1. PCS system size is expandable to an ultimate capacity of at least 1.35 times total I/O points indicated.
2. Design and install system networks to achieve ultimate capacity with only addition of I/O modules and associated wiring and cable. Design and install initial network infrastructure to support ultimate capacity without having to remove and replace portions of network installation.
3. Operator interfaces installed initially do not require hardware and software additions and revisions for system when operating at ultimate capacity.

E. Environmental Conditions for Controllers and Switches:

1. Products to operate without performance degradation under ambient environmental temperature, pressure, and humidity conditions encountered for installed location.

a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure to be internally insulated, electrically heated, cooled, and ventilated as required by product and application.

2. Protect products with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House products not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location dictates the following NEMA 250 enclosure requirements:

    a. Outdoors: Type 4X.
    b. Indoors, Heated: Type 12.
    c. Localized Areas Exposed to Washdown: Type 4.
    d. Chlorine Room: Type 4X.

F. Environmental Conditions for Instruments and Actuators:

1. Instruments and actuators to operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.

    a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure is internally insulated, electrically heated, and ventilated as required by instrument and application.

2. Protect instruments, actuators, and accessories with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House instruments and actuators not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location is to dictate the following NEMA 250 enclosure requirements:

    a. Outdoors: Type 4X.
    b. Indoors, Heated: Type 4X.
    c. Localized Areas Exposed to Washdown: Type 4.
    d. Chlorine Room: Type 4X.

G. Electric Power Quality:

1. Power-Line Surges:

    a. ProtectPCS system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.
    b. Do not use fuses for surge protection.
    c. Test protection in the normal mode and in the common mode, using the following two waveforms:

        1) 8-by-20-microsecond waveform with a peak voltage of 1000 V and a peak current of 500 A.

2. Power Conditioning:

    a. Protect PCS system products connected to ac power circuits from irregularities and noise rejection. Characteristics of power-line conditioner are as follows:

1) At 85 percent load, output voltage to not deviate by more than plus or minus 1 percent of nominal when input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
2) During load changes from zero to full load, output voltage to not deviate by more than 3 percent of nominal.
3) Accomplish full correction of load switching disturbances within five cycles, and 95 percent correction within two cycles of onset of disturbance.
4) Total harmonic distortion to not exceed 3 percent at full load.

3. Ground Fault: Protect products from ground fault by providing suitable grounding. Products to not fail due to ground fault condition.

H. UPS:

1. PCS system products powered by UPS units are to include the following:

a. PLC controllers and I/O modules.
b. PCS communications modules.
c. PCS operator interface terminals.
d. PCS network switches.
e. Panel-mounted lights and sounders.
f. Instruments and field devices connected to I/O modules.

I. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems are to automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.04 PCS SYSTEM OPERATOR INTERFACES

A. Operator Means of System Access: Operator able to access entire PCS system through any of multiple means including, but not limited to, the following:

1. HMI touchscreen display mounted on front of PCS PLC enclosure.
2. Portable operator terminal with hardwired connection through LAN port.
3. Remote connection through remote access.

B. Make access to system, regardless of operator means used, transparent to operator.

C. Network Ports: For hardwired connection of portable workstation. Network port easily accessible, properly protected, clearly labeled, and installed at the following locations:

1. Inside PLC Panel PLC-001.

2.05 NETWORKS

A. Acceptable networks for connecting workstations and PLC controllers include the following:

1. IP.
2. ISO/IEC/IEEE 8802-3, Ethernet.

2.06 PCS OPERATOR INTERFACE TERMINAL

A. Description: A touchscreen HMI display mounted to enclosure doors.

B. Basis of Design: Allen Bradley PanelView Plus 7.

C. Requirements:

1. Display: Minimum 10-inch TFT color touchscreen display capable of displaying SVGA screen resolution (800x600) minimum.
2. Nonvolatile Memory: 512 MB.
3. Type: Rated NEMA 250 Type 4/4X for indoor use.
4. Network Interface: Built-in 10-100-1000 Base TX Ethernet with RJ-45 connector port.
5. USB: USB port for external USB drive.
6. CF Card: CF card slot for data logging.

2.07 SYSTEM SOFTWARE

A. System Software Minimum Requirements:

1. Operator interface software to include day-to-day operator transaction processing, alarm and report handling, operator privilege level and data segregation control, custom programming, and online data modification capability.
2. Scheduling software to schedule centrally based time and event, temporary, and exception day programs.

B. Operator Interface Software:

1. Minimize operator training through use of English language prorating and English language point identification.
2. Minimize use of a typewriter-style keyboard through use of a pointing device similar to a mouse.
3. Make operator sign-off a manual operation or, if no keyboard or mouse activity takes place, an automatic sign-off.
4. Make automatic sign-off period programmable from one to 60 minutes in one-minute increments on a per operator basis.
5. Security Access:

a. Use password control for operator access to PCS system.
b. Assign an alphanumeric password (field assignable) to each operator.
c. Grant operators access to PCS system by entry of proper password.

d. Use same operator password regardless of which computer or other operator interface means are used.
e. Automatically update additions or changes made to passwords.
f. Assign each operator an access level to restrict access to data and functions the operator is cable of performing.
g. Provide software with at least five access levels.
h. Assign each menu item an access level so that a one-for-one correspondence between operator assigned access level(s) and menu item access level(s) is required to gain access to menu item.
i. Display menu items to operator with those capable of access highlighted. Make menu and operator access level assignments online programmable and under password control.

6. Operators able to perform commands including, but not limited to, the following:

a. Start or stop selected equipment.
b. Adjust set points.
c. Add, modify, and delete time programming.
d. Enable and disable process execution.
e. Lock and unlock alarm reporting for each point.
f. Enable and disable totalization for each point.
g. Enable and disable trending for each point.
h. Override control loop set points.
i. Enter temporary override schedules.
j. Enter and modify analog alarm limits.
k. Enter and modify analog warning limits.

7. Reporting:

a. Generated manually.
b. Sent to displays and disc files.
c. Types of Reporting:

1) General listing of points.
2) List points currently in alarm.
3) List of off-line points.
4) List points currently in override status.
5) List of disabled points.
6) List points currently locked out.

8. Summaries: For specific points, for a logical point group, for an operator selected group(s), or for entire system without restriction due to hardware configuration.

C. Graphic Interface Software:

1. Include a full interactive graphical selection means of accessing and displaying system data to operator.
2. Include a hierarchical-linked dynamic graphic operator interface for accessing and displaying system data and commanding and modifying equipment operation. Interface is

to use pull-down or penetrating menus, color, and animation to facilitate operator understanding of system.

3. Make descriptors for graphics, points, alarms, and such modifiable through operator's workstation under password control.
4. Make graphic displays online user definable and modifiable using the hardware and software provided.
5. Make data displayed within a graphic assignable regardless of physical hardware address, communication, or point type.
6. Make graphics online programmable and under password control.
7. Make points assignable to multiple graphics where necessary to facilitate operator understanding of system operation.
8. Graphics to also contain software points.
9. Penetration within a graphic hierarchy is to display each graphic name as graphics are selected to facilitate operator understanding.
10. Display operator accessed data on the monitor.
11. Provide operator with ability to select further penetration using pointing device to click on a site, building, floor, area, equipment, and so on. Display defined and linked graphic below that selection.
12. Include operator with means to directly access graphics without going through penetration path.
13. Make dynamic data assignable to graphics.
14. Display points (physical and software) with dynamic data provided by PCS system with appropriate text descriptors, status or value, and engineering unit.
15. Use color, rotation, or other highly visible means, to denote status and alarm states. Make colors variable for each class of points, as chosen by operator.
16. For operators with appropriate privilege, command points directly from display using pointing device.

    a. For an analog command point such as set point, display current conditions and limits so operator can position new set point using pointing device.
    b. For a digital command point such as valve position, show valve in current state such as open or closed so operator could select alternative position using pointing device.
    c. Include a keyboard equivalent for those operators with that preference.

17. Provide graphic generation software to allow operator ability to add, modify, or delete system graphic displays.

D. Project-Specific Graphics: Graphics documentation including, but not limited to, the following:

1. Control schematic for each of following, including a graphic system schematic representation, similar to that indicated on Drawings**,** with point identification, set point and dynamic value indication.
2. Graphic display for each piece of equipment connected to PCS system through a data communications link. Include dynamic indication of all points associated with equipment.

E. Alarm Handling Software:

1. Include alarm handling software to report all alarm conditions monitored and transmitted through PCS controllers.

2. Include first in, first out handling of alarms in accordance with alarm priority ranking, with most critical alarms first, and with buffer storage in case of simultaneous and multiple alarms.
3. Make alarm handling active at all times to ensure that alarms are processed even if an operator is not currently signed on to PCS system.
4. Alarms display is to include the following:

    a. Indication of alarm condition such as "Abnormal Off," "Hi Alarm," and "Low Alarm."
    b. "Analog Value" or "Status" group and point identification with native language point descriptor such as "Fuel Blend Tank T-1 High High Level."
    c. Discrete per point alarm action message, such as "Call Maintenance Dept. Ext-5561."
    d. Include extended message capability to allow assignment and printing of extended action messages. Capability is to be operator programmable and assignable on a per point basis.

5. Direct alarms to appropriate operator interface terminals and individual operators by privilege level and segregation assignments.
6. Send text and voice messages to designated operators for critical alarms.
7. Process and categorize alarms by class as described in Attachment A “Control Narrative.”

    a. Class 1:

        1) Associated with fire, security, and other extremely critical equipment monitoring functions; have alarm, trouble, return to normal, and acknowledge conditions printed and displayed.
        2) Unacknowledged alarms to be placed in unacknowledged alarm buffer.
        3) All conditions make an audible alarm sound and require individual acknowledgment to silence audible sound.

    b. Class 2:

        1) Critical, but not life-safety related, and processed same as Class 1 alarms, except do not require individual acknowledgment.
        2) Acknowledgement may be through a multiple alarm acknowledgment.

    c. Class 3:

        1) General alarms; printed, displayed, and placed in unacknowledged alarm buffer queues.
        2) Configure so each new alarm received makes an audible alarm sound that are silenced by "acknowledging" alarm or by pressing a "silence" key.
        3) Make acknowledgement of queued alarms either on an individual basis or through a multiple alarm acknowledgement.
        4) Print alarms returning to normal condition without an audible alarm sound or require acknowledgment.

    d. Class 4:

1) Routine maintenance or other types of warning alarms.
2) Alarms to be printed only, with no display, no audible sound and no acknowledgment required.

8. Include an unacknowledged alarm indicator on display to alert operator that there are unacknowledged alarms in system. Operator able to acknowledge alarms on an individual basis or through a multiple alarm acknowledge key.

F. Reports and Logs:

1. Include reporting software package that allows operator to select, modify, or create reports using PCS system I/O point data available.
2. Setup each report so data content, format, interval, and date are operator definable.
3. Sample and store report data on PCS controller, within storage limits of PCS controller, and then uploaded to archive on server for historical reporting.
4. Make it possible for operators to obtain real-time logs of all I/O points by type or status, such as alarm, point lockout, or normal.
5. Store reports and logs on server hard drives in a format that is readily accessible by other standard software applications, including spreadsheets and word processing.

G. Standard Reports: Provide standard PCS system reports with operator ability to customize reports later.

1. All I/O: With current status and values.
2. Alarm: All current alarms, except those in alarm lockout.
3. Disabled I/O: All I/O points that are disabled.
4. Alarm Lockout I/O: All I/O points in alarm lockout, whether manual or automatic.
5. Alarm Lockout I/O in Alarm: All I/O in alarm lockout that are currently in alarm.
6. Logs:

a. Alarm history.
b. System messages.
c. System events.
d. Trends.

H. Custom Reports: Operator able to easily define and prepare any system data into a daily, weekly, monthly, annual, or other historical report. Reports to include a title with time and date stamp.

I. Standard Trends:

1. Trend all I/O point present values, set points, and other parameters indicated for trending.
2. Preset trend intervals for each I/O point after review with Owner.
3. Make trend intervals operator selectable from 1 second up to 60 minutes. Make minimum number of consecutive trend values stored at one time 100 per variable.
4. When drive storage memory is full, overwrite oldest data with most recent data.
5. Make archived and real-time trend data available for viewing numerically and graphically by operators.
6. Make exporting of reports to Microsoft Excel or Word as standard features.

2.08 ENCLOSURES

A. General:

1. House each controller and associated control accessories in single enclosure. Enclosure is to serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies, and transformers.
2. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.
3. Freestanding enclosures maximum of 48 inches wide and 72 inches high.
4. Supply each enclosure with complete set of as-built schematics, tubing, and wiring diagrams and product literature located in pocket on inside of door.

B. Internal Arrangement:

1. Arrange internal layout of enclosure to group and protect electric, and electronic components associated with controller, but not an integral part of controller.
2. Arrange layout to group similar products together.
3. Include a barrier between line-voltage and low-voltage electrical and electronic products.
4. Factory or shop install products, tubing, cabling, and wiring complying with requirements and standards indicated.
5. Terminate field cable and wire using heavy-duty terminal blocks.
6. Include spare terminals, equal to not less than 20 percent of used terminals.
7. Include spade lugs for stranded cable and wire.
8. Install maximum of two wires on each side of terminal.
9. Include enclosure field electric power supply with toggle-type switch located at entrance inside enclosure to disconnect power.
10. Include enclosure with line-voltage nominal 20 A GFCI duplex receptacle for service and testing tools. Wire receptacle on hot side of enclosure disconnect switch and include with 5 A circuit breaker.
11. Mount products within enclosure on removable internal panel(s).
12. Include products mounted in enclosures with engraved, laminated phenolic nameplates (black letters on a white background). Nameplates are to have at least 1/4-inch-high lettering.
13. Route tubing cable and wire located inside enclosure within a raceway with continuous removable cover.
14. Label each end of cable, wire, and tubing in enclosure following an approved identification system that extends from field I/O connection and all intermediate connections throughout length to controller connection.
15. Size enclosure internal panel to include at least 25 percent spare area on face of panel.

C. Environmental Requirements:

1. Evaluate temperature and humidity requirements of each product to be installed within each enclosure.
2. Calculate enclosure internal operating temperature considering heat dissipation of all products installed within enclosure and ambient effects (solar, conduction, and wind) on enclosure.

3. Where required by application, include temperature-controlled electrical heat to maintain inside of enclosure above minimum operating temperature of product with most stringent requirement.
4. Where required by application, include temperature-controlled ventilation fans with filtered louver(s) to maintain inside of enclosure below maximum operating temperature of product with most stringent requirement.
5. Include temperature-controlled cooling within the enclosure for applications where ventilation fans cannot maintain inside temperature of enclosure below maximum operating temperature of product with most stringent requirement.
6. Where required by application, include humidity-controlled electric dehumidifier or cooling to maintain inside of enclosure below maximum relative humidity of product with most stringent requirement and to prevent surface condensation within enclosure.

D. Freestanding, NEMA 250, Type 12:

1. NRTL listed in accordance with UL 508A.
2. Seams and joints are continuously welded and ground smooth.
3. Modular single or double door floor standing enclosure.
4. Externally formed body flange around perimeter of enclosure face.
5. Type 12 Enclosure Sizes:

    a. Single-door modular enclosure sizes up to 72 inches tall by 36 inches wide.
    b. Double-door modular enclosure sizes up to 72 inches tall by 48 inches wide.

6. Frames are roll-formed, welded design made of 12 gauge steel with sold steel, fully welded corners.
7. Frames accommodate the 25-mm DIN standard and include rectangular holes for clip nuts and through holes for use with thread-forming screws.
8. External sides, covers and door constructed of 16 or 14 gauge steel.
9. Finish enclosure with polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Exterior Color: Gray.
    b. Interior Color: Gray.

10. Corner-formed door, full size of enclosure face, supported using multiple concealed hinges with easily removable hinge pins.
11. Doors fitted with three-point (top, middle, and bottom) latch system with latching rod rollers and single, heavy-duty, oiltight handle with integral locking mechanism.
12. Removable internal panel, 0.093 inch thick, with white polyester powder coating that is electrostatically applied and then baked to bond to substrate.
13. Internal panel mounting studs with hardware, grounding hardware, and sealing washers.
14. Grounding stud on enclosure body.
15. Thermoplastic pocket on inside of door for record Drawings and Product Data.
16. Equip top of enclosure with no fewer than two lifting eyes.
17. Internal rack-mount shelves and angles, as required by application.

E. Accessories:

1. Ventilation Fans, Filtered Intake, and Exhaust Grilles:

a. Number and size of fans, filters, and grilles, as required by application.
b. Compact cooling fans engineered for 50,000 hours of continuous operation without lubrication or service.
c. Fans capable of being installed on any surface and in any position within enclosure for spot cooling or air circulation.
d. Thermostatic control with adjustable set point from 32 to 140 deg F.
e. Airflow Capacity at Zero Pressure:

1) 4-Inch (100-mm) Fan: 100 cfm.
2) 6-Inch (150-mm) Fan: 240 cfm.
3) 10-Inch (250-mm) Fan: 560 cfm.

f. Maximum operating temperature of 158 deg F.
g. 4-inch fan thermally protected and provided with permanently lubricated ball-bearings.
h. 6- and 10-inch fans with ball-bearing construction and split capacitor motors thermally protected to avoid premature failure.
i. Dynamically balanced impellers molded from polycarbonate material.
j. Fan furnished with power cord and polarized plug for power connection.
k. Fan brackets, finger guards, and mounting hardware provided with fans to complete installation.
l. Removable Intake and Exhaust Grilles: ABS plastic, of size to match fan size and suitable for NEMA 250, Types 1 and 12 enclosures.
m. Filters for NEMA 250, Type 12 Enclosures: Disposable, of size to match intake grille.

2.09 RELAYS

A. General-Purpose Relays:

1. NRTL listed.
2. Heavy-duty, electromechanical type; rated for at least 10 A at 30 V dc and at 240 V ac and 60 Hz.
3. SPDT, DPDT, or three-pole double-throw, as required by control application.
4. Plug-in-style relay with 8-pin octal or multiblade plug for DPDT relays and 11-pin octal or multiblade plug for three-pole double-throw relays.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a clear transparent polycarbonate dust-tight cover.
7. Include LED indication.
8. Performance:

a. Mechanical Life: At least 10 million cycles.
b. Electrical Life: At least 100,000 cycles at rated load.
c. Pickup Time: 15 ms or less.
d. Dropout Time: 10 ms or less.
e. Pull-in Voltage: 85 percent of rated voltage.
f. Dropout Voltage: 50 percent of nominal rated voltage.
g. Power Consumption: 5 VA or less.
h. Ambient Operating Temperatures: Minus 40 to 115 deg F

9. Equip relays with coil transient suppression to limit transients to non-damaging levels.
10. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
11. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

B. Multifunction Time-Delay Relays:

1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 24 V dc and at 240 V ac and 60 Hz.
3. Relay with up to 8 programmable functions to provide on/off delay, interval, one-shot interval, and recycle timing functions.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a dust-tight cover.
7. Include knob and dial scale for alternative digital interface for setting delay time.
8. Visual Status Indication: Power "On" and Output "On" status.
9. Performance:

    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Timing Ranges: Multiple ranges from 0.1 seconds to 100 minutes.
    d. Repeatability: Within 2 percent.
    e. Recycle Time: 45 ms.
    f. Minimum Pulse-Width Control: 50 ms.
    g. Power Consumption: 5 VA or less.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

10. Equip relays with transient suppression to limit transients to non-damaging levels.
11. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
12. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

C. Latching Relays:

1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 30 V dc and at 250 V ac and 60 Hz.
3. SPDT, DPDT, or three-pole double-throw, as required by control application.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a clear transparent polycarbonate dust-tight cover.
7. Performance:

    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Pickup Time: 15 ms or less.
    d. Dropout Time: 10 ms or less.
    e. Pull-in Voltage: 85 percent of rated voltage.
    f. Dropout Voltage: 50 percent of nominal rated voltage.

g. Power Consumption: 5 VA or less.
h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
9. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
10. Relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

2.10 ELECTRICAL POWER DEVICES

A. DC Power Supplies:

1. Description: Linear or switched, regulated power supplies with ac input to one or multiple dc output(s).

a. Include both line and load regulation to ensure stable output.
b. To protect both power supply and load, include power supply with an automatic current limiting circuit.

2. Features:

a. Housing: Enclose circuitry in a housing.
b. Local Adjustment: Include screw adjustment on exterior of housing for dc voltage output.
c. Mounting: DIN rail.
d. Visual status indicator.

3. Performance:

a. Input Voltage: Nominally 120 V ac, 60 Hz.
b. Output Voltage: Nominally 24 V dc with plus or minus 1 V dc adjustment.
c. Output Current: Minimum 5 A.
d. Load Regulation: Within 0.1 percent.
e. Line Regulation: Within 0.05 percent.
f. Stability: Within 0.1 percent of rated volts after warmup period.
g. Ripple: 1 mV rms.

2.11 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS

A. Furnish local UPS units, of type indicated, installed with PCS system.

B. DIN Rail Mounted UPS:

1. Provide continuous, regulated output power without using batteries during brown-out, surge, and spike conditions.
2. Performance:

a. Capacity: Load not to exceed 75 percent of rated capacity.
b. Efficiency: Minimum 94 percent.
c. Input Voltage: Single phase, 120 V ac, compatible with field power source.
d. Load Power Factor Range (Crest Factor): 0.65 to 1.0.
e. Output Voltage: 101 to 132 V ac, while input voltage varies between 89 and 152 V ac.
f. On Battery Output Voltage: Sine wave.
g. Inverter Overload Capacity: Minimum 150 percent for 30 seconds.
h. Battery Backup: 15 minutes of operation at full load with battery power.
i. Battery Recharge Time: Maximum of six hours to 90 percent capacity after full discharge.
j. Transfer Time: 6 ms.
k. Surge Voltage Withstand Capacity: IEEE C62.41.1 and IEEE C62.41.2, Categories A and B.

3. Automatic bypass operation during fault or overload conditions.
4. Integral line-interactive, power condition topology to eliminate all power contaminants.
5. Include power switch and visual indication of power, battery, fault.
6. Include audible alarm of faults with silence feature.
7. Include dry contacts (digital output points) for low battery condition and battery-on (primary utility power failure). Points shall be connected to the PCS.
8. Batteries: Sealed; maintenance free; replacement without dropping load.

2.12 NETWORK EQUIPMENT

A. Industrial network switches shall have copper (RJ45) ports required for interconnection of the PCS system. Switches shall include a minimum of 2 unallocated copper 100-BaseT ports for temporary maintenance and future equipment access.

B. PLC mounted equipment shall be Allen-Bradley/Rockwell Automation Stratix 5800 series.

C. Hardware firewall shall be Ubiquiti Unifi USG Security Gateway.

2.13 PRESSURE INSTRUMENTS

A. Pressure Transmitters

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Endress+Hauser.
b. Rosemount.
c. Or approved equal.

2. Source Limitations: Obtain pressure transmitters from single manufacturer.
3. Performance:

a. Accuracy: Plus or minus 0.05 percent.

b. Input/Outputs: One (1) analog output (4-20 mA).
c. Registration: Pounds per square inch.
d. Display: Integral digital readout.
e. Ambient Temperature: Minus 40 to 185 deg F.

4. Construction:

a. Body: Stainless steel or aluminum, NEMA 4X, IP66 rated.
b. Housing: Two chamber stainless steel or aluminum.
c. Sensor range: 0 to 270 psig.
d. Rating: NSF 61 compliant wetted components via EPDM isolation diaphragm.

2.14 TEMPERATURE INSTRUMENTS

A. Space Air Temperature Sensors

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Moore Industries.
b. Or approved equal.

2. Platinum RTD:

a. 1000-ohm platinum RTD at 0 deg C and a temperature coefficient of 0.00385 ohm/ohm/deg C.
b. Two wire, PTFE-insulated, 22-gauge stranded copper leads.

3. Performance:

a. Range: Minus 40 to 140 deg F.
b. Input/Output: One analog output (4-20 mA).
c. Interchangeable Accuracy: At 32 deg F within 0.5 deg F.
d. Repeatability: Within 0.5 deg F.
e. Self-heating: Negligible.

4. Temperature Transmitter Requirements:

a. Mating transmitter required.

5. Space Air Temperature Sensor Accessories:

a. Insulating Bases: For room temperature sensors located on exterior walls.
b. Thermostat Guards: Locking transparent plastic mounted on separate base.

2.15 FLOW INSTRUMENTS

A. Comply with requirements in Section 407113 “Magnetic Flow Meter” for electromagnetic flowmeters.

2.16 LEVEL INSTRUMENTS

A. Hydrostatic Level Sensor

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Endress+Hauser.
    b. Or approved equal.

2. Description: Loop-powered, submersible transducer and transmitter with support cord, interconnecting cable with cable shield, and vent tube for atmospheric reference.
3. The vent tube shall be provided with a replaceable moisture barrier.
4. Installation shall allow easy removal of the transducer and cable assembly for maintenance.
5. The electronic signal transmitter shall be incorporated in the transducer and shall produce a 4-20 mA dc signal linearly proportional to the operating pressure range.
6. A weatherproof enclosure housing the vent tube moisture barrier shall be furnished with the sensor.
7. Sensor probe shall be no more 12 inches long and 1.5 inches in diameter.
8. The measurement system shall be supplied with integral water density compensation via integral temperature sensor.
9. Performance:

    a. Range: Span shall be 0 – 30 feet full scale with minimum sensor extension cable length of 40 feet, with cable suspension mounting fixture and weight.
    b. Input/Output: One analog output (4-20 mA).
    c. Submersible transducer shall be suitable for sensing pressure equivalent to liquid level ranged indicated at the specific water depth.
    d. Sensor extension cable shall have a pull strength of 200 pounds, be factory attached to the transducer, and shall be terminated in a furnished weatherproof enclosure.
    e. Ambient Temperature:

        1) Transducer: 14 to 158 deg F.
        2) Sensor Cable: Minus 22 to 158 deg F.
        3) Weatherproof enclosure: Minus 40 to 176 deg F.

10. Construction:

    a. Sensor Probe: 316L stainless steel probe with 316L stainless steel isolating diaphragm and EPDM seal.
    b. Sensor Extension Cable: Abrasion-resistant cable; twisted copper wires; aluminum shield; TPE insulation; pressure compensation tube with Teflon filter.
    c. All wetted parts shall be NSF-61 certified for potable water.
    d. Enclosure: Polycarbonate or aluminum housing.
    e. Enclosure Rating: NEMA 4X or IP66/67.

B. Float Level Switches

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. SJE Rhomus.
    b. Or approved equal.

2. Mounting: Suitable for application; horizontal or vertical.
3. Performance:

    a. Level Actuation and De-Actuation Deadband: 3.0 inches.
    b. Electrical Rating: 0.1 A at 30 V dc.

4. Wetted Parts Construction:

    a. Float: Polypropylene.
    b. Cable: High-impact, corrosion resistance CPE.
    c. All wetted parts shall be NSF-61 certified for potable water.
    d. Switch Type: Mercury-free snap switch.

2.17 CHLORINE ANALYZERS

A. Comply with requirements in Section 407521 “Chlorine Analyzers” for chlorine analyzers.

2.18 POSITION LIMIT SWITCHES

A. Source Limitations: Obtain position limit switches from single manufacturer.

B. Description: Select type of actuating head (plunger, roller lever, or rod) to suit application.

C. Performance:

1. Life Expectancy: Not less than 5 million mechanical operations and 50,000 electrical operations.
2. Voltage: 125, 250, 480, and 600 V ac or 8, 12, 14, 24, 30, 48, 125, and 250 V dc, as required by application.
3. Current Rating: As required by application.
4. Temperature Rise: 90 deg F.
5. Ambient Temperature: Minus 20 to 185 deg F.

D. Construction:

1. Enclosure Material: Metal with corrosion-resistant finish.
2. NEMA 250, Type 4X, as required by application
3. Switch Type: SPDT or DPDT, as required by application.
4. Electrical Connection: Screw or plug-in terminals.
5. Conduit Connection: 1/2 inch NPT.

2.19 ACTUATED VALVES

A. Comply with requirements in Section 400551 “Plant Valves” for control valves used in process controls.

2.20 CONTROL WIRE AND CABLE

A. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables" for instrumentation and control circuit cables and conductors.

2.21 RACEWAYS

A. Comply with requirements in Section 260533.13 “Conduits for Electrical Systems” for low-voltage control raceways.

B. Comply with requirements in Section 260533.16 “Boxes and Covers for Electrical Systems” for boxes and covers for low-voltage control boxes.

2.22 PROCESS TUBING

A. Products in this article are intended for signals to instruments connected to process piping.

B. Stainless Steel Tubing (for Process Tubing):

1. Seamless Type 316 stainless steel, Grade TP, cold drawn, annealed and pickled, and free from scale.
2. Chemical and physical properties in accordance with ASTM A269/A269M.
3. Diameter, as required by application, of not less than nominal 3/8 inch.
4. Wall thickness, as required by application, but not less than 0.035 inch.
5. Furnish stainless steel tubing in 20 ft. straight random lengths.

C. Stainless Steel Tubing Connectors and Fittings (for Process Tubing) - Stainless Steel, Compression Type:

1. Connectors and fittings constructed from Type 316 stainless steel, with collets, flareless type.
2. Single or double ferrule design creating a constant tension between fitting body and fitting nut for leak-free seal.
3. Connect instruments to tubing with connectors having compression connector on one end and IPS or NPT thread on other end.

2.23 SOURCE QUALITY CONTROL

A. Product(s) and material(s) will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for products to verify actual locations of connections before installation.

1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
2. Examine roughing-in for control valves installed in piping to verify actual locations of piping connections before installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, control valve assemblies, tubing, piping wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a seismic event, wind, impact, or other forces common to the application.

D. Install ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

E. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

F. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

G. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."

H. Welding Requirements:

1. Restrict welding and burning to supports and bracing.
2. No equipment is cut or welded without approval. Welding or cutting will not be approved if there is risk of damage to adjacent Work.
3. Welding, where approved, is to be by inert-gas electric arc process and is to be performed by qualified welders in accordance with applicable welding codes.
4. If requested on-site, show satisfactory evidence of welder certificates indicating ability to perform welding work intended.

I. Fastening Hardware:

1. Wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

J. Corrosive Environments:

1. Use products that are suitable for environment to which they will be subjected.
2. When conduit is located in a corrosive environment (including all process areas), use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with corrosive-resistant coating that is suitable for environment. Comply with requirements for installation of raceways and boxes specified in Section 260533.13 “Conduits for Electrical Systems."
3. Where instruments are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

3.03 INSTALLATION OF ENCLOSURES

A. Install the following items in enclosures, to comply with indicated requirements:

1. PLC control systems.
2. Industrial network switches.
3. Network equipment.
4. Electrical power devices.
5. UPS units.
6. Relays.
7. Accessories.
8. Actuators.
9. Instrument terminal boxes.

B. Align top of adjacent enclosures of like size.

C. Install floor-mounted enclosures located on concrete housekeeping pads. Attach enclosure legs using galvanized-steel or stainless steel anchors.

D. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireways used for application are to have protection equal to NEMA 250 rating of connected enclosures.

3.04 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to PCS system products requiring electrical power connections.

B. Design of electrical power to products not indicated with electric power is delegated to PCS system provider and installing trade to provide a fully functioning PCS system. Work is to comply with NFPA 70 and other requirements indicated.

C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.

E. Comply with requirements in Section 260533.13 “Conduits for Electrical Systems for electrical power raceways.

F. Comply with requirements in Section 260533.16 “Boxes and Covers for Electrical Systems” for electrical power boxes.

3.05 INSTALLATION OF IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.

B. Install laminated acrylic or melamine plastic signs with unique identification on face for each of the following:

1. PLC equipment.
2. Enclosure.
3. Electrical power device.
4. UPS unit.
5. Accessory.

C. Install stainless steel instrumentation identification tags (metal tags) for each instrument or field device connected to PCS.

D. Install stainless steel instrumentation identification tags (metal tags) for each control valve actuator connected to PCS controller.

E. Warning Labels and Signs:

1. Permanently attach to equipment that can be automatically started by PCS system.

2. Locate where highly visible near power service entry points.

3.06 INSTALLATION OF NETWORKS

A. Install balanced twisted pair cables when connecting between the following network devices to interconnect all PLC and PCS components together in accordance with requirements of Sections 271513 “Communications Copper Horizontal Cabling.”

3.07 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

3.08 PRESSURE INSTRUMENTS INSTALLATION

A. Installation of pressure transmitters shall comply with instrument manufacturer’s written instructions.

3.09 TEMPERATURE INSTRUMENTS INSTALLATION

A. Mount air temperature transmitters on wall. Use manufacturer’s mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Temperature instruments having performance impacted by temperature of mounting substrate shall be isolated with an insulating barrier located between instrument and substrate to eliminate effect. Where instruments requiring insulation nor located in finished space, conceal insulating barrier in a cover matching the instrument cover.

C. Mounting Height:

1. Mount temperature instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.

D. Installation of Space Temperature Sensor:

1. Conceal assembly in an electrical box of sufficient size to house sensor and transmitter, if provided.
2. Install electrical box with a faceplate to match sensor cover if sensor cover does not completely cover electrical box.
3. In finished areas, recess electrical box within wall.
4. In unfinished areas, electrical box may be surface mounted if electrical light switches are surface mounted. Use a cast-aluminum electric box for surface-mounted installations.
5. Align electrical box with other electrical devices such as visual alarms and light switches located in the vicinity to provide a neat and well-thought-out arrangement. Where possible, align in both horizontal and vertical axis.

3.10 INSTALLATION OF FLOW INSTRUMENTS

A. Comply with requirements in Section 407113 “Magnetic Flow Meter.”

3.11 INSTALLATION OF LEVEL INSTRUMENTS

A. Hydrostatic Level Sensors:

1. Installation of hydrostatic level sensors shall comply with instrument manufacturer’s written instructions.
2. Suspend level sensor using manufacturer suppled suspension clamp. Follow manufacturer’s written instructions when attaching suspension clamp and inserting level sensor extension cable through suspension clamp.
3. Connect level sensor extension cable to manufacturer supplied weatherproof terminal box as directed in the manufacturer’s written instructions. Connect control circuit from terminal box to the process control system.

B. Float Level Switches:

1. Installation of float level switches shall comply with instrument manufacturer’s written instructions.

3.12 INSTALLATION CHLORINE ANALYZERS

A. Comply with requirements in Section 407521 “Chlorine Analyzers.”

3.13 INSTALLATION OF POSITION LIMIT SWITCHES

A. Mounting Location:

1. Rough-in instrument-mounting locations before setting instruments and routing, cable, wiring, and conduit to final location.
2. Use manufacturer mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

3.14 ACTUATED VALVES

A. Comply with requirements in Section 400551 “Plant Valves.”

3.15 INSTALLATION OF PROCESS TUBING

A. Install process tubing for signal to instruments in liquid and steam systems. Instruments include, but are not limited to, the following:
1. Sensors.
2. Transmitters.

B. Support tubing in accordance with MSS SP-58, but at intervals no more than 60 inches apart.

C. Install minimum NPS 1/2 process tubing for industrial-grade sensors, transmitters, and switches. Install bushings where required.

D. Make smooth tubing bends with a bending tool. Flattened or wrinkled bends are unacceptable.

E. Support tubing independent of other trades.

F. Route tubing parallel to and at right angles to building construction.

G. Install tubing concealed in areas with ceilings.

H. Install dirt leg with an isolation valve and threaded plug in drain valve at each connection to a transmitter and switch.

I. Insulate process piping and tubing connected to process systems for personnel protection if surface temperature exceeds 120 deg F. Only insulate piping and tubing within maintenance personnel reach from floor, platform, or catwalk.

J. Wrap pipe threads of fitting in process tubing with service temperatures below 350 deg F with single wrap of PTFE tape.

K. Coat pipe threads of fittings on process tubing in services with temperatures exceeding 350 deg F with pipe compound before being made up to reduce possibility of galling.

L. Do not make tubing connections to a fitting before completing makeup of connection.

M. Check tubing for correct diameter and wall thickness. Cut the tube ends square and deburred. Exercise care during cutting to keep tubing round.

N. Do not install fittings close to a bend. Straight length of tubing, not deformed by bending, is required for proper connection.

O. Align tubing with fitting when installed. Avoid springing tube into position.

P. Install tubing with extreme care to keep foreign matter out of system. Plug open tubing ends to keep out dust, dirt, and moisture.

Q. Do not attach tubing to equipment that may be removed frequently for maintenance or may impart vibration and expansion from temperature change.

R. Protect exposed tubing in mechanical equipment rooms from inadvertent mechanical damage within 76 inches above floor. Use aluminum channel reversed and secured over tubing to protect tubing from damage.

S. Identify above-grade process tubing as follows:

1. Every 50 ft. of straight run.
2. At least once for each branch within 36 inches of main tee.
3. Near each change in direction.

4. Within 36 inches of each ceiling, floor, roof, and wall penetration.
5. Where exposed to and where concealed from view, including above ceiling plenums, shafts, and chases.
6. Near each isolation valve.
7. Mark each instrument tube connection with a number-coded identification. Each unique tube is to have same unique number at instrument connection and termination at opposite end of tube.

T. Process Tubing Isolation Valves Installation:

1. Install valves full size of piping and tubing.
2. Install isolation valves at the following locations:

    a. Process connection.
    b. Inlet to each instrument including, sensors, transmitters, switches, gauges, and other control devices.

3. Locate valves to be readily accessible from floor.
4. Install needle valves for isolation and throttling applications. Option to install ball valves in lieu of needle valves for isolation only applications.

3.16 INSTALLATION OF CONTROL WIRE, CABLE, AND RACEWAY

A. Comply with NECA 1.

B. Wire and Cable Installation:

1. Comply with installation requirements in Section 260523 "Control-Voltage Electrical Power Cables."
2. Comply with installation requirements in Section 271513 "Communications Copper Horizontal Cabling."
3. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.

    a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.

4. Terminate wiring in a junction box.

    a. Clamp cable over jacket in a junction box.
    b. Individual conductors in the stripped section of cable is to be slack between the clamping point and terminal block.

5. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
6. Install signal transmission components in accordance with IEEE C2, REA Form 511a, NFPA 70, and as indicated.
7. Use shielded cable to transmitters.

8. Use shielded cable to temperature sensors.
9. Perform continuity and meager testing on wire and cable after installation.

C. Conduit Installation:

1. Comply with Section 260533.13 “Conduits for Electrical Systems” for control-voltage conductors.
2. Comply with Section 260533.16 “Boxes and Covers for Electrical Systems” for control-voltage conductors.
3. Comply with Section 270528 "Pathways for Communications Systems" for balanced twisted pair cabling.

3.17 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

B. Tests and Inspections: Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.18 PCS SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

E. Control Valve Checkout:
1. Verify that control valves are installed correctly for flow direction.
2. Verify that valve body attachment is properly secured and sealed.
3. Verify that valve actuator and linkage attachment are secure.
4. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
5. Verify that valve ball, disc, or plug travel is unobstructed.
6. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace valve if leaks persist.

F. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction, and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type, and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments, verify the following:

    a. Sensing element type and proper material.
    b. Length and insertion.

3.19 PCS SYSTEM I/O ADJUSTMENT, CALIBRATION, AND TESTING

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration to comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

1. Use field testing and diagnostic instruments and equipment with an accuracy at least twice the instrument accuracy of instrument to be calibrated. For example, test and calibrate an installed instrument with accuracy of 1 percent using field testing and diagnostic instrument with accuracy of 0.5 percent or better.

F. Calibrate each instrument in accordance with instruction manual supplied by instrument manufacturer.

G. If after calibration the indicated performance cannot be achieved, replace out-of-tolerance instruments.

H. Test all I/O channels not connected to field instruments, control valves, or other process field devices.

I. Analog Signals:
1. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
2. Check resistance signals for temperature sensors at zero, zero, 50, and 100 percent of operating span using a precision-resistant source.

J. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact making or breaking.

K. Control Valves:

1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.
3. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

L. Meters: Check meters at zero, 50, and 100 percent of Project design values.

M. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

N. Switches: Calibrate switches to make or break contact at set points indicated.

O. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.20 PCS SYSTEM CHECKOUT

A. Verify power supply.

1. Verify voltage, phase, and hertz.
2. Verify that protection from power surges is installed and functioning.
3. Verify that ground fault protection is installed.
4. If applicable, verify if connected to UPS unit.
5. If applicable, verify if connected to backup power source.
6. If applicable, verify that power conditioning units are installed.

B. Verify that wire and cabling are properly secured to terminals and labeled with unique identification.

C. Verify that spare I/O capacity is provided.

3.21 PCS SYSTEM I/O CONTROL LOOP TESTS

A. Testing:

1. Test every I/O point connected to PCS controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.

2. Test every I/O point throughout its full operating range.
3. Test every control loop to verify that operation is stable and accurate.
4. Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5. Test and adjust every control loop for proper operation according to sequence of operation.
6. Test software and hardware interlocks for proper operation. Correct deficiencies.
7. Operate each analog point at the following:

    a. Upper quarter of range.
    b. Lower quarter of range.
    c. At midpoint of range.

8. Exercise each digital point.
9. For every I/O point in PCS system, read and record each value at operator workstation, at operator interface terminal, at PCS controller, and at field instrument simultaneously. Value displayed at operator workstation, at operator interface terminal, at PCS controller, and at field instrument must match.
10. Prepare and submit report documenting results for each I/O point in PCS system and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

3.22 PCS SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After approval of Pretest Checklist and Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed Pretest Checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.
2. Required mechanical installation work is successfully completed and equipment is working correctly.
3. Process equipment motors operate below full-load amperage ratings.
4. Required PCS system components, wiring, and accessories are installed.
5. Installed PCS system architecture matches approved Drawings.
6. Control electric power circuits operate at proper voltage and are free from faults.
7. Required surge protection is installed.
8. PCS system network communications function properly, including uploading and downloading programming changes.
9. Each controller's programming is backed up.
10. Equipment, products, tubing, wiring cable, and conduits are properly labeled.
11. All I/O points are programmed into controllers.
12. Valves and actuators zero and span adjustments are set properly.

13. Each control valve and actuator goes to failed position on loss of power and loss of signal.
14. Meter, sensor, and transmitter readings are accurate and calibrated.
15. Control loops are tuned for smooth and stable operation.
16. View trend data where applicable.
17. Each controller works properly in standalone mode.
18. Safety controls and devices function properly.
19. Electrical interlocks function properly.
20. Operator interface terminals and other interfaces are delivered, all system and database software is installed, and graphics are created.
21. Record Drawings are completed.

E. Test Plan:

1. Prepare and submit validation Test Plan including test procedures for performance validation tests.
2. Address all specified functions of PCS system and control sequences as outlined in Attachment A: Control Narrative in Test Plan.
3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
4. Explain method for simulating necessary conditions of operation used to demonstrate performance.
5. Include Test Checklist to be used to check and initial that each test step has been successfully completed.
6. Submit Test Plan documentation 10 business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in PCS system.

    a. Verify analog I/O points at operating value.
    b. Make adjustments to out-of-tolerance I/O points.

        1) Identify I/O points for future reference.
        2) Simulate abnormal conditions to demonstrate proper function of safety devices.
        3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.

2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of PCS system to establish desired conditions.
4. 24 hours after initial validation test, do as follows:

    a. Re-check I/O points that required corrections during initial test.
    b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.

5. 24 Hours after second validation test, do as follows:

a. Re-check I/O points that required corrections during second test.
b. Continue validation testing until I/O point is normal on two consecutive tests.

6. Completely check out, calibrate, and test all connected hardware and software to ensure that PCS system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit report indicating results of testing. For all I/O points that required correction, indicate how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

3.23 FINAL REVIEW

A. Submit written request to Owner when PCS system is ready for final review. State the following:

1. PCS system has been thoroughly inspected for compliance with Contract Documents and found to be in full compliance.
2. PCS system has been calibrated, adjusted, and tested and found to comply with requirements of operational stability, accuracy, speed, and other performance requirements indicated.
3. PCS system monitoring and control of process systems results in operation according to control sequences indicated in Attachment A “Control Narrative”.
4. PCS system is complete and ready for final review.

B. Upon receipt of written request for final review, Owner will start review within 10 business days and upon completion issue field report(s) documenting observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in reviewer's field report(s) and submit second written request after all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Compensation for Subsequent Reviews: Should more than two reviews be required, PCS system manufacturer and Installer shall compensate entity/entities performing reviews for total costs (labor and expenses) associated with subsequent reviews. Estimated cost of each subsequent review to be submitted and approved by PCS system manufacturer and Installer before review.

E. Prepare and submit closeout submittals when no deficiencies are reported.

F. Part of PCS system final review to include demonstration to parties participating in final review.

1. Provide staff familiar with PCS system installed to demonstrate operation of PCS system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of PCS system that is requested by reviewers during final review.
3. Demonstration to include, but not be limited to, the following:

a. Accuracy and calibration of 20 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by

reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.

b. Demonstrate all validation tests with the Owner's Representative present as a witness. Demonstration shall be carried out as described under "Validation Test."
c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored.
d. Reporting of alarm conditions for randomly selected alarms to ensure that alarms are properly received by operators and operator workstations.
e. Trends, summaries, logs, and reports set up for Project.
f. Software's ability to communicate with controllers, operator workstations, and uploading and downloading of control programs.
g. Software's ability to edit control programs offline.
h. Data entry to show Project-specific customizing capability including parameter changes.
i. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
j. Execution of digital and analog commands in graphic mode.
k. System speed of response compared to requirements indicated.
l. For Each PCS Controller:

    1) Memory: Programmed data, parameters, trend, and alarm history collected during normal operation are not to be lost during power failure.
    2) Operator Interface: Ability to connect directly to each type of digital controller with portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
    3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
    4) Electric Power: Ability to disconnect any controller safely from its power source.
    5) Wiring Labels: Match control drawings.
    6) Network Communication: Ability to locate controller's location on network and communication architecture matches Shop Drawings.
    7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators, and devices.

m. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management.

    1) Data Presentation: On each operator interface terminal, demonstrate graphic display capabilities.
    2) Set-Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated.
    3) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.

4) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.

3.24 MAINTENANCE SERVICE

A. Beginning at Substantial Completion, verify that maintenance service includes 12 months' full maintenance by PCS system manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration, and adjusting as required for proper operation. Use only manufacturer's authorized replacement parts and supplies.

3.25 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, verify that service agreement includes software support for two year(s).

3.26 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain PCS system.

B. Extent of Training:

1. Base extent of training on scope and complexity of PCS system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
3. Minimum Training Requirements:

    a. Provide not less than two days of training total.
    b. Stagger training over multiple training classes to accommodate Owner's requirements. All training to occur before end of warranty period.
    c. Break down total days of training into not more than two separate training classes.
    d. Schedule training so each training class is not less than two consecutive day(s).

C. Training Schedule:

1. Schedule training with Owner 20 business days before expected Substantial Completion.
2. Schedule training to provide Owner with at least 10 business days of notice in advance of training.
3. Training to occur within normal business hours at mutually agreed on time. Unless otherwise agreed to, training to occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions. Each morning session and afternoon session to be split in half with 15-minute break between sessions. Morning

and afternoon sessions to be separated by 60-minute lunch period. Training, including breaks and excluding lunch period, are not to exceed eight hours per day.

4. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

1. Request from Owner in advance of training a proposed attendee list with name, phone number, and email address.
2. Provide preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Include preprinted sign-in sheet with training session number, date and time, instructor name, phone number, email address, and brief description of content to be covered during session. List attendees with columns for name, phone number, and email address and a column for attendee signature or initials.
4. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
5. At end of each training day, send Owner an email with attachment of scanned copy (PDF) of circulated sign-in sheet for each session. Indicate which attendees, if any, joined for only part of training sessions.

E. Training Attendee Headcount:

1. Plan in advance of training for two five Insert number attendees.
2. Make allowance for Owner to add up to two attendee(s) at time of training.
3. Headcount may vary depending on training content covered in session. Attendee access may be restricted to some training content for purposes of maintaining system security.

F. Training Attendee Prior Knowledge: For guidance in planning required training and instruction, assume attendees have the following:

1. High school education and degree.
2. Basic user knowledge of computers and office applications.
3. Basic knowledge of PCS systems.
4. Basic knowledge of PCS system and products installed.

G. Instructor Requirements:

1. One or multiple qualified instructors, as required, to provide training.

H. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:

    a. Daily operators.
    b. Advanced operators.
    c. System managers and administrators.

2. Plan and organize training sessions to group training content to protect PCS system security. Some attendees may be restricted to some training sessions to ensure PCS system security.

I. Training Outline:

1. Submit training outline for Owner review at least 10 business day(s) before scheduling training.
2. Include in outline a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session, and synopses for each lesson planned.

J. On-Site Training:
1. Provide as much of training located on-site as deemed feasible and practical by Owner.
2. Include on-site training with regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration, and service requirements.

K. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding PCS system architecture and configuration.
3. Understanding each unique product type installed including performance and service requirements for each.
4. Understanding operation of each system and equipment controlled by PCS system including sequences of operation, each unique control algorithm, and each unique optimization routine.
5. Logging on and off system.
6. Accessing graphics, reports, and alarms.
7. Adjusting and changing set points and time schedules.
8. Recognizing PCS system malfunctions.
9. Understanding content of operation and maintenance manuals including control drawings.
10. Understanding physical location and placement of PCS controllers and I/O hardware.
11. Accessing data from PCS controllers.
12. Running each specified report and log.
13. Displaying and demonstrating each data entry to show Project-specific customizing capability. Demonstrating parameter changes.
14. Stepping through graphics penetration tree, displaying all graphics, demonstrating dynamic updating, and direct access to graphics.
15. Executing digital and analog commands in graphic mode.
16. Demonstrating the following for process systems and equipment controlled by PCS system:

    a. Operation of process equipment in normal-off, normal-on, and failed conditions while observing individual equipment and valves for correct position under each condition.
    b. For process equipment with factory-installed software, show that integration into PCS system is able to communicate with PCS controller.

c. Hardware interlocks and safeties function properly and PCS system performs correct sequence of operation after electrical power interruption and resumption after power is restored.
d. Reporting of alarm conditions for each alarm, and confirm that alarms are received at assigned locations, including operator workstations.
e. Each control loop responds to set-point adjustment and stabilizes within time period indicated.

L. Training Content for Advanced Operators:
1. Creating, deleting, and modifying point trend logs including graphing and printing on an ad-hoc basis and operator-defined time intervals.
2. Creating, deleting, and modifying reports.
3. Creating, deleting, and modifying points.
4. Performing PCS system checkout and diagnostic procedures.
5. Performing PLC controller operation and maintenance procedures.
6. Performing operator workstation operation and maintenance procedures.
7. Maintaining, calibrating, troubleshooting, diagnosing, and repairing hardware.
8. Adjusting, calibrating, and replacing PCS system components.

M. Training Content for System Managers and Administrators:

1. PCS system software maintenance and backups.
2. Uploading, downloading, and offline archiving of all PCS system software and databases.
3. Interface with Project-specific, third-party operator software.
4. Understanding password and security procedures.
5. Adding new operators and making modifications to existing operators.
6. Operator password assignments and modification.
7. Operator authority assignment and modification.
8. Workstation data segregation and modification.

END OF SECTION

SECTION 406000 - ATTACHMENT B- I/O LIST

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Project:	City & Borough of Yakutat Airport Water System Extension
Project #:	I0297.24002
Title:	Section 406000 Attachment B - I/O List
Design:	NK
Drawn:	REM
Checked:	KHD
Date:	4/16/2025

TAG	DESCRIPTION	I/O ADDRESS	I/O TYPE	SIGNAL TYPE	CONFIGURED RANGE/SETPOINT	UNITS	REMARKS
XS-010A	BOOSTER PUMP BP-01 RUN STATUS CONTACT	S01CH00	DI	24 VDC	N/A	N/A	
XS-010B	BOOSTER PUMP BP-01 FAULT ALARM CONTACT	S01CH01	DI	24 VDC	N/A	N/A	
XS-012A	BOOSTER PUMP BP-03 RUN STATUS CONTACT	S01CH02	DI	24 VDC	N/A	N/A	
XS-012B	BOOSTER PUMP BP-03 FAULT ALARM CONTACT	S01CH03	DI	24 VDC	N/A	N/A	
XS-013A	RE-CIRCULATION PUMP (RC-01) RUN STATUS CONTACT	S01CH04	DI	24 VDC	N/A	N/A	
XS-013B	RE-CIRCULATION PUMP (RC-01) FAULT ALARM CONTACT	S01CH05	DI	24 VDC	N/A	N/A	
XS-014A	CHLORINE DOSING PUMP CP-01 RUN STATUS CONTACT	S01CH06	DI	24 VDC	N/A	N/A	
XS-014B	CHLORINE DOSING PUMP CP-01 FAULT ALARM CONTACT	S01CH07	DI	24 VDC	N/A	N/A	
ASH-020	CHLORINE ROOM GAS DETECTOR PANEL ALARM CONTACT	S01CH08	DI	24 VDC	0.5	PPM	SETPOINT CONFIGURED AT CHLORINE ROOM GAS DETECTOR PANEL
XS-300A	PLC UPS ON BATTERY STATUS CONTACT	S01CH09	DI	24 VDC	N/A	N/A	
XS-300B	PLC UPS LOW BATTERY ALARM CONTACT	S01CH10	DI	24 VDC	N/A	N/A	
XS-102A	ATS CONNECTED TO UTILITY POWER DRY CONTACT	S01CH11	DI	24 VDC	N/A	N/A	
XS-102B	ATS CONNECTED TO GEN POWER DRY CONTACT	S01CH12	DI	24 VDC	N/A	N/A	
XS-102C	ATS UTILITY POWER FAILURE ALARM CONTACT	S01CH13	DI	24 VDC	N/A	N/A	
XS-102D	ATS FAILURE TO SWITCH TO GENERATOR ALARM CONTACT	S01CH14	DI	24 VDC	N/A	N/A	
SPARE	SPARE I/O POINT FOR FUTURE USE	S01CH15	DI	24 VDC	N/A	N/A	
XS-011A	BOOSTER PUMP BP-02 RUN STATUS CONTACT	S02CH00	DI	24 VDC	N/A	N/A	
XS-011B	BOOSTER PUMP BP-02 FAULT ALARM CONTACT	S02CH01	DI	24 VDC	N/A	N/A	
XS-103A	GENERATOR AUTO/HAND STATUS CONTACT	S02CH02	DI	24 VDC	N/A	N/A	
XS-103B	GENERATOR RUN STATUS CONTACT	S02CH03	DI	24 VDC	N/A	N/A	
XS-103C	GENERATOR FAULT ALARM CONTACT	S02CH04	DI	24 VDC	N/A	N/A	
LSL-101	DAY TANK LOW LEVEL ALARM CONTACT	S02CH05	DI	24 VDC	N/A	N/A	
LSH-101	DAY TANK HIGH LEVEL ALARM CONTACT	S02CH06	DI	24 VDC	N/A	N/A	
XS-204A	CATHODIC PROTECTION SYSTEM STATUS CONTACT	S02CH07	DI	24 VDC	N/A	N/A	
XS-204B	CATHODIC PROTECTION SYSTEM TROUBLE ALARM CONTACT	S02CH08	DI	24 VDC	N/A	N/A	
ZSC-202	WATER STORAGE TANK HATCH INTRUSION SWITCH	S02CH09	DI	24 VDC	N/A	N/A	
LSHH-201	WATER STORAGE TANK HIGH-HIGH LEVEL SWITCH	S02CH10	DI	24 VDC	284	INCHES	FLOAT LEVEL SWITCH MOUNTED AT ELEVATION OF 23 FEET 8 INCHES.
LSLL-201	WATER STORAGE TANK LOW-LOW LEVEL SWITCH	S02CH11	DI	24 VDC	42	INCHES	FLOAT LEVEL SWITCH MOUNTED AT ELEVATION OF 3 FEET 6 INCHES.
XS-203A	WATER STORAGE TANK MIXER RUN STATUS CONTACT	S02CH12	DI	24 VDC	N/A	N/A	
XS-203B	WATER STORAGE TANK MIXER ALARM CONTACT	S02CH13	DI	24 VDC	N/A	N/A	
ST-014	CHLORINE DOSING PUMP SPEED FEEDBACK	S02CH14	DI	PULSE	0-100	%	PROVIDE INTERFACE CIRCUIT BETWEEN THIS INPUT POINT AND CHLORINE DOSING PUMP SPEED PULSE OUTPUT POINT.
SPARE	SPARE I/O POINT FOR FUTURE USE	S02CH15	DI	24 VDC	--	--	
RESERVED	RESERVED FOR FUTURE WELL PUMP CONTROLS	S03CH00	DI	24 VDC	--	--	
RESERVED	RESERVED FOR FUTURE WELL PUMP CONTROLS	S03CH01	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH02	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH03	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH04	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH05	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH06	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH07	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH08	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH09	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH10	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH11	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH12	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH13	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH14	DI	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S03CH15	DI	24 VDC	--	--	
XY-010	BOOSTER PUMP BP-01 START/STOP COMMAND	S04CH00	DO	24 VDC	N/A	N/A	
XY-011	BOOSTER PUMP BP-02 START/STOP COMMAND	S04CH01	DO	24 VDC	N/A	N/A	
XY-012	BOOSTER PUMP BP-03 START/STOP COMMAND	S04CH02	DO	24 VDC	N/A	N/A	
XY-013	RE-CIRCULATION PUMP (RC-01) START/STOP COMMAND	S04CH03	DO	24 VDC	N/A	N/A	
XY-014	CHLORINE DOSING PUMP CP-01 START/STOP COMMAND	S04CH04	DO	24 VDC	N/A	N/A	
XY-203	WATER STORAGE TANK MIXER MXR-01 START/STOP COMMAND	S04CH05	DO	24 VDC	N/A	N/A	
RESERVED	RESERVED FOR FUTURE WELL PUMP CONTROLS	S04CH06	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH07	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH08	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH09	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH10	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH11	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH12	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH13	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH14	DO	24 VDC	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S04CH15	DO	24 VDC	--	--	
FIT-001	WATER TANK FILL LINE FLOWMETER	S05CH00	AI	4-20 MA	0-400	GPM	
FIT-005	CBY INTERTIE LINE FLOWMETER	S05CH01	AI	4-20 MA	0-800	GPM	
FIT-006	AIRPORT SUPPLY LINE FLOWMETER	S05CH02	AI	4-20 MA	0-800	GPM	
FIT-008	RE-CIRCULATION LINE FLOWMETER	S05CH03	AI	4-20 MA	0-40	GPM	
PIT-003	BOOSTER PUMP SUCTION WATER PRESSURE TRANSMITTER	S05CH04	AI	4-20 MA	0-100	PSIG	
PIT-004	BOOSTER PUMP DISCHARGE WATER PRESSURE TRANSMITTER	S05CH05	AI	4-20 MA	0-100	PSIG	
AIT-007	FREE CHLORINE CONCENTRATION TRANSMITTER	S05CH06	AI	4-20 MA	0-10	PPM	

Project:	City & Borough of Yakutat Airport Water System Extension
Project #:	I0297.24002
Title:	Section 406000 Attachment B - I/O List
Design:	NK
Drawn:	REM
Checked:	KHD
Date:	4/16/2025

TAG	DESCRIPTION	I/O ADDRESS	I/O TYPE	SIGNAL TYPE	CONFIGURED RANGE/SETPOINT	UNITS	REMARKS
ST-011	BOOSTER PUMP BP-02 SPEED FEEDBACK	S05CH07	AI	4-20 MA	0-60	HZ	
ST-010	BOOSTER PUMP BP-01 SPEED FEEDBACK	S06CH00	AI	4-20 MA	0-60	HZ	
ST-012	BOOSTER PUMP BP-03 SPEED FEEDBACK	S06CH01	AI	4-20 MA	0-60	HZ	
ZT-002	WATER STORAGE TANK LEVEL CONTROL VALVE POSITION FEEDBACK	S06CH02	AI	4-20 MA	0-100	% OPEN	
TT-021	PUMP ROOM AMBIENT TEMPERATURE TRANSMITTER	S06CH03	AI	4-20 MA	0-120	DEG F	
LT-200	WATER STORAGE TANK LEVEL SENSOR	S06CH04	AI	4-20 MA	360	INCHES	
ST-013	RE-CIRCULATION PUMP (RC-01) SPEED FEEDBACK	S06CH05	AI	4-20 MA	--	--	
RESERVED	RESERVED FOR FUTURE WELL PUMP CONTROLS	S06CH06	AI	4-20 MA	--	--	
RESERVED	RESERVED FOR FUTURE WELL PUMP CONTROLS	S06CH07	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH00	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH01	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH02	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH03	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH04	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH05	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH06	AI	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S07CH07	AI	4-20 MA	--	--	
SY-010	BOOSTER PUMP BP-01 VFD SPEED CONTROL	S08CH00	AO	4-20 MA	0-60	HZ	
SY-012	BOOSTER PUMP BP-03 VFD SPEED CONTROL	S08CH01	AO	4-20 MA	0-60	HZ	
LV-002	WATER STORAGE TANK LEVEL CONTROL VALVE	S08CH02	AO	4-20 MA	0-100	% OPEN	
SY-014	CHLORINE DOSING PUMP CP-01 SPEED CONTROL	S08CH03	AO	4-20 MA	0-60	HZ	
SY-013	RE-CIRCULATION PUMP (RC-01) VFD SPEED CONTROL	S08CH04	AO	4-20 MA	--	--	
RESERVED	RESERVED FOR FUTURE WELL PUMP CONTROLS	S08CH05	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S08CH06	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S08CH07	AO	4-20 MA	--	--	
SY-011	BOOSTER PUMP BP-02 VFD SPEED CONTROL	S09CH00	AO	4-20 MA	0-60	Hz	
SPARE	SPARE I/O POINT FOR FUTURE USE	S09CH01	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S09CH02	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S09CH03	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S09CH04	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S09CH05	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S09CH06	AO	4-20 MA	--	--	
SPARE	SPARE I/O POINT FOR FUTURE USE	S09CH07	AO	4-20 MA	--	--	

SECTION 407113 - ELECTROMAGNETIC FLOW METER, LIQUID, SINGLE-CHANNEL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section describes the requirements for a flow sensor.

B. Under this item, the contractor shall furnish and install the flow measurement equipment and accessories as indicated on the plans and as herein specified.

1.02 QUALITY ASSURANCE

A. Referenced Standards and Guidelines - Complies with applicable portions of ANSI/AWWA Standards and NSF/ANSI/CAN Standard 61, Annex G. There are currently no AWWA standards that specifically address electromagnetic metering.

1. Flow measurement function complies with Industry Standards

    a. ANSI B16.5 Class 150 RF
    b. AWWA Class B
    c. NEMA 4X/6P (IP67/IP68)
    d. CSA

1.03 SUBMITTALS

A. The following information shall be included in the submittal for this section:

1. Outline dimensions, conduit entry locations and weight
2. Customer connection and power wiring diagrams
3. Data sheets and catalog literature for microprocessor-based transmitter and sensor
4. Interconnection drawings
5. Installation and operations manual
6. List of spare parts
7. Complete technical product description including a complete list of options provided

1.04 DEFINITIONS

A. Transmitter – Device used for increasing the power of a signal. It does this by taking energy from a power supply and controlling the output to match the input signal shape but with larger amplitude.

B. Sensor Coils – Also called an “induction loop”, an electromagnetic communication or detection system which generates a magnetic field to induce an electrical current in a nearby wire.

1.05 WARRANTY

A. The manufacturer of the above specified equipment warrants the Product to be free from defects in materials and workmanship appearing within the earlier of either: One (1) year after installation; or one (1) year and six (6) months after shipment from manufacturer.

1.06 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 – PRODUCTS

1.06 APPROVED 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. Badger Meter
2. Rosemount
3. Or Equal

1.07 OPERATING CONDITIONS

A. System Components

1. Metering Tube (Sensor)
2. Transmitter

PART 3 - EXECUTION

1.08 INSTALLATION

A. Follow manufacturer’s recommendation for installation. Installation will conform to the guidelines provided by the Installation & Operation Manual.

B. Straight pipe requirement shall follow manufacturer's specifications.

1.09 CALIBRATION

A. Each meter shall be hydraulically calibrated in an ISO 17025-certified testing facility, which utilizes a computerized gravimetric testing method with a measuring uncertainty of 0.1%.

B. Each meter shall be provided with a calibration certificate indicating the measured error (percent deviation) at three different flows, respectively equivalent to 25%, 50% and 75% of the nominal flow rate for each size.

END OF SECTION

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SECTION 407521 - CHLORINE ANALYZER

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Potable water chlorine analyzer for continuous monitoring of free or total chlorine.

1.02 REFERENCES

A. ANSI/AWWA B301- Standard for Liquid Chlorine

B. NSF/ANSI 61- Drinking Water System Components – Health Effects

C. EPA 334.0- Determination of Residual Chlorine in Drinking Water

D. UL61010-1- Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

1.03 SUBMITTALS

A. Section 013300 “Submittal Procedures”: Requirements for submittals.

B. Product data including manufacturer’s specifications, dimensions, and performance data.

C. Certifications demonstrating compliance with NSF/ANSI 61 and EPA Method 334.0.

1.04 CLOSEOUT SUBMITTALS

A. Section 017700 “Closeout Procedures”: Requirements for submittals.

B. Operation and maintenance (O&M) manuals.

1.05 QUALITY ASSURANCE

A. The chlorine analyzer shall be manufactured by a company with at least five (5) years of experience in producing water quality monitoring equipment.

1.06 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
   a. American Iron and Steel (AIS)
   b. Build America, Buy America Act
B. See Supplementary Conditions for details.

PART 2 - PRODUCTS

2.01 CHLORINE ANALYZER

A. The analyzer shall continuously measure free or total chlorine residual in potable water applications using a reagentless, electrochemical, three-electrode amperometric sensor with automatic pH compensation.

B. Waste stream shall be clean water with no reagents.

C. The system shall include the following components:

1. Sensor – Amperometric chlorine sensor capable of measuring free or total chlorine from 0 to 20 mg/L.
2. Controller – Digital controller with a backlit display for real-time monitoring and data logging.
3. Flow Cell – Flow-based sample conditioning system with a constant flow regulator.

D. The analyzer shall have the following features:

1. Accuracy : ±10% of the reference test (DPD) at stable pH less than 8.5 (±0.5 pH unit from the pH at calibration).
2. Response Time : 140 s or less for 90% change (T90) at a stable temperature and pH.
3. Sampling Time: Continuous
4. Sample Temperature: 5°C to 45°C (41°F to 113°F).
5. Sample Flow Rate: 7.9 - 13.2 gal/hour
6. Lower Level of Detection (LOD): 0.03 ppm
7. pH Range: 4-9
8. Outputs: At least two (2) 4-20 mA analog outputs, and Modbus or SCADA-compatible digital output.
9. Sensor Power Requirements: 12 Vdc.
10. Controller Power Requirements: 120 Vac.

E. All chlorine analyzer system components shall be furnished mounted to a stainless steel panel suitable for wall mounting. The chlorine analyzer system assembly envelope shall not exceed 19.00 inches (H) x 19.50 inches (W) x 6.00 inches (D). The chlorine analyzer system controller may be mounted separately from the panel.

F. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Hach
2. Endress+Hauser
3. Halogen Systems, Inc.
4. Or equal.

EXECUTION

2.02 INSTALLATION

A. The analyzer shall be installed in accordance with the manufacturer's written instructions.

B. Mount the analyzer at a location that provides easy access for maintenance and calibration.

C. Ensure proper flow conditions and water temperature to maintain measurement accuracy.

D. Electrical wiring shall conform to NEC and local electrical codes.

2.03 TESTING AND COMMISSIONING

A. Verify installation and wiring connections before applying power.

B. Conduct startup and calibration per manufacturer's recommendations.

C. Demonstrate proper operation to the Owner's representative.

D. Provide training on operation, calibration, and maintenance.

2.04 WARRANTY AND MAINTENANCE

A. The manufacturer shall provide a minimum one-year warranty covering defects in materials and workmanship.

B. Spare parts and consumables shall be available for at least five years after installation.

C. Provide scheduled maintenance recommendations and troubleshooting guidance.

END OF SECTION

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SECTION 422331 – VERTICAL AND HORIZONTAL CENTRIFUGAL BOOSTER PUMPS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Vertical in-line, multi-stage centrifugal pumps complete with motor and coupling.
2. Split-coupled end-suction centrifugal pumps complete with motor and coupling.

B. Related Work:

1. Section 26 29 23- Variable-Frequency Motor Controllers

1.02 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For potable water pumps to include in operation and maintenance manuals.

1.05 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.

1. American Iron and Steel (AIS)

2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 - PRODUCTS

2.01 VERTICAL IN-LINE MULTI-STAGE CENTRIFUGAL PUMPS

A. Pump shall be vertical in-line centrifugal pump.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Grundfos Pumps Corp.
2. Goulds Water Technology; a Xylem brand.
3. Or equal.

C. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

D. Pump Construction:

1. Pump Head: Cast Iron
2. Base: Cast Iron
3. Impeller: Stainless steel
4. Motor: Variable Frequency Controlled, unless otherwise indicated.
5. Rating: NSF 61 certified.

E. Furnish and install vertical in-line centrifugal pumps as per plans and pump schedule.

F. The pump, electric motor, motor support bracket, coupling and coupling guard shall be factory assembled at the pump manufacturer’s facility. The pump manufacturer shall have complete unit responsibility.

2.02 HORIZONTAL SPLIT-COUPLED END-SUCTION CENTRIFUGAL PUMPS

A. The pumps shall be split coupled, single stage, end suction.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Grundfos Pumps Corp.
2. Goulds Water Technology; a Xylem brand.
3. Or equal.

C. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

D. Pump Construction:

1. Housing: Cast Iron
2. Shaft: Stainless Steel
3. Impeller: Stainless steel
4. Motor: Variable Frequency Controlled, unless otherwise indicated.
5. Rating: NSF 61 certified.

E. Furnish and install end suction split coupled pumps as per plans and pump schedule.

F. The pump, electric motor, motor support bracket, coupling and coupling guard shall be factory assembled at the pump manufacturer’s facility. The pump manufacturer shall have complete unit responsibility.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of potable water piping system to verify actual locations of connections before pump installation.

3.02 INSTALLATION

A. Comply with HI 1.4.

B. Install pumps per manufacturer specifications.

C. Coordinate suction line elevation with water tank connection. Ensure suction pipe remains level.

D. Install and secure pumps to a concrete housekeeping pad.

3.03 CONNECTIONS

A. Comply with requirements for piping specified in Section 405020 "Plant Pipes and Fittings." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping to allow service and maintenance.

C. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

1. Horizontally mounted, in-line, separately coupled centrifugal pumps.
2. Horizontally mounted, in-line, close-coupled centrifugal pumps.
3. Vertically mounted, in-line, close-coupled centrifugal pumps.

D. Install shutoff valve on suction side of each pump and shutoff valves on discharge side of each pump. Install check valves and strainers as indicated in the project documents. Install valves same size as connected piping. Comply with requirements for valves specified in Section 400551 “Plant Valves”.

3.04 IDENTIFICATION

A. Comply with requirements for identification specified in Section 400597 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.05 STARTUP SERVICE

A. Engage an authorized representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

4. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
5. Start motor.
6. Open discharge valve slowly.

3.06 ADJUSTING

A. Adjust domestic water pumps to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

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SECTION 463300 - LIQUID CHEMICAL FEED SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Chemical Injection Pumps
   2. Chemical Solution Tank

1.02 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 013300.

B. Submit complete fabrication, assembly foundation, and installation drawings for all pumps, motors and accessories to illustrate construction and assembly of components.

C. Manufacturer’s installation instructions and check out instructions.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data: Include manufacturer's literature, cleaning procedures, replacement parts lists, and wiring diagrams, for pumps and motors.

1.04 DELIVERY STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Accept chemical metering pumps and accessories on site in factory packing. Inspect for damage upon delivery to site.

C. Store and safeguard equipment, materials, instructions, and spare parts in accordance with manufacturer's written instructions.

1.05 QUALITY ASSURANCE

A. Chemical metering pumps and accessories shall be supplied by a single manufacturer.

1.06 WARRANTY

A. The chemical metering pump manufacturer shall provide a five-year warranty from equipment start-up. All other components shall carry a two-year warranty.

1.07 BUY AMERICAN REQUIREMENTS

A. Provide certificates to show that all products meet the following requirements.
1. American Iron and Steel (AIS)
2. Build America, Buy America Act

B. See Supplementary Conditions for details.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

B. Chemical injection pump shall comply with NSF 50.

C. Design Characteristics:

1. Chemical: Calcium Hypochlorite

2. Solution: 0.16%
3. Min/Max Required Output: 0.004 – 4.00 gph
4. Rated Injection Pressure: 100psi
5. Pump Signals:
   a. Pump Run Status Contact
   b. Pump Start/Stop Command Input
   c. Pump Speed Control Input: 4-20mA

2.02 CHEMICAL SOLUTION INJECTION PUMP (CP-01)

A. Solenoid-driven chemical feed pump intended for liquid injection of calcium hypochlorite and enclosed in a chemically resistant housing.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. LMI
2. Stenner
3. Pulsafeed
4. Or Equal

2.03 CHEMICAL SOLUTION TANK (CT-01)

A. Tank shall be cylindrical process chemical tank with lid.

B. Tank shall be doubled walled for secondary containment.

C. Tank shall be intended for liquid containment of calcium hypochlorite.

D. Size: 15 gallons

E. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Peabody Engineering ProChem
2. LMI
3. Pulsafeed
4. Or Equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Follow manufacturer's recommendation for installation. Installation will conform to the guidelines provided by the Installation & Operation Manual.

3.02 INSPECTION

A. Verify that structures, piping, and equipment are compatible.

3.03 ADJUST

A. Start-up: Start-up equipment system and make adjustments required to place system in proper operating condition.

B. Calcium hypochlorite solution will be provided by the operator of the City and Borough of Yakutat Water System. Coordinate with operator for initial mixing and filling of the solution tank prior to testing the chlorination system equipment.

END OF SECTION

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