

STATE OF ALASKA

INVITATION TO BID (ITB)

PIPE ORDER

22-VSW-UNK-039
MARCH 9, 2022

IMPORTANT NOTICE: If you received this solicitation from the State of Alaska's "Online Public Notice" web site, you must register with the procurement officer listed below in order to receive notification of subsequent amendments to the solicitation. Failure to register with the procurement officer may result in the rejection of your offer.

BIDDER'S NOTICE: By signature on this form, the bidder certifies that they comply with the following:

- (1) the bidder has a valid Alaska business license or will obtain one prior to award of any contract resulting from this ITB. If the bidder possesses a valid Alaska business license, the license number must be written below or one the following forms of evidence submitted with the bid:
- a canceled check for the business license fee;
 - a copy of the business license application with a receipt date stamp from the State's business license office;
 - a receipt from the State's business license office for the license fee;
 - a copy of the bidder's valid business license;
 - a sworn notarized affidavit that the bidder has applied and paid for a business license;
- (2) the price(s) submitted was arrived at independently and without collusion, under penalty of perjury, and that the bidder is complying with:
- the laws of the State of Alaska;
 - the applicable portion of the Federal Civil Rights Act of 1964;
 - the Equal Employment Opportunity Act and the regulations issued thereunder by the state and federal government;
 - the Americans with Disabilities Act of 1990 and the regulations issued thereunder by the state and federal government;
 - the bid will remain open and valid for at least 90 days;
 - all terms and conditions set out in this Invitation to Bid (ITB).

If a bidder does not hold an Alaska Business License (1) at the time designated in the ITB for opening the state will disallow the Alaska Bidder Preference. Bids must also be submitted under the name as appearing on the bidder's current Alaska business license in order to receive the Alaska Bidder Preference. If a bidder fails to comply with (2) of this paragraph, the state may reject the bid, terminate the contract, or consider the contractor in default.

Evan Patterson Procurement Officer	_____ COMPANY SUBMITTING BID	*DOES YOUR BUSINESS QUALIFY FOR THE Minority Business Enterprise (MBE) or Women Business Enterprise (WBE) PREFERENCE? [] YES [] NO
	_____ AUTHORIZED SIGNATURE	
Phone: (907) 269-7674	_____ PRINTED NAME	*SEE ITB FOR EXPLANATION OF CRITERIA TO QUALIFY
Email: evan.patterson@alaska.gov	_____ DATE	_____ TELEPHONE NUMBER
_____ ALASKA BUSINESS LICENSE NUMBER	_____ FEDERAL TAX ID NUMBER	_____ E-MAIL ADDRESS

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SECTION 1. INTRODUCTION & INSTRUCTIONS

SEC. 1.01 PURPOSE OF THE ITB

The Department of Environmental Conservation, Division of Water, Village Safe Water Program (department) is soliciting bids for a one time purchase of various pipe that includes the option for additional as-needed purchases for the same products for indefinite quantities.

SEC. 1.02 DEADLINE FOR RECEIPT OF BIDS

Bids must be received no later than 2:00 PM Alaska Time on March 30, 2022, at which time they will be publicly opened. Late bids or amendments will be disqualified and not opened or accepted for evaluation.

SEC. 1.03 PRIOR EXPERIENCE

No specific minimums have been set for this ITB.

SEC. 1.04 INVITATION TO BID (ITB) REVIEW

Bidders shall carefully review this ITB for defects and questionable or objectionable material. Comments concerning defects and questionable or objectionable material in the ITB should be made in writing and received by the procurement officer at least ten days before the bid opening date. This will allow time for an amendment to be issued if one is required. It will also help prevent the opening of a defective bid, upon which award cannot be made, and the resultant exposure of bidders' prices.

SEC. 1.05 QUESTIONS PRIOR TO DEADLINE FOR RECEIPT OF BIDS

All questions must be in writing and directed to the procurement officer. The interested party must confirm telephone conversations in writing. Two types of questions generally arise. One may be answered by directing the questioner to a specific section of the ITB. These questions may be answered over the telephone. Other questions may be more complex and may require a written amendment to the ITB. The procurement officer will make that decision.

SEC. 1.06 SITE INSPECTION

Section not used.

SEC. 1.07 SUBMITTING BIDS

Bids shall be submitted via email, the bid may be emailed to john.mcdonald@alaska.gov and must contain the ITB number in the subject line of the email. The maximum size of a single email (including all text and attachments) that can be received by the state is 20mb (megabytes). If the email containing the bid exceeds this size, the bid must be sent in multiple emails that are each less than 20 megabytes and each email must comply with the requirements described above.

Please note that email transmission is not instantaneous. Similar to sending a hard copy bid, if you are emailing your bid, the state recommends sending it enough ahead of time to ensure the email is delivered by the deadline for receipt of bid.

It is the bidder's responsibility to contact the issuing agency at john.mcdonald@alaska.gov to confirm that the bid has been received. The state is not responsible for unreadable, corrupt, or missing attachments.

SEC. 1.08 BID FORMS

Bidders shall use the front page of this ITB and any other forms identified in this ITB for submitting bids. All bids must be signed by an individual authorized to bind the bidder to the provisions of the ITB.

BIDDER'S CERTIFICATION

By signature on the bid, the bidder certifies that they comply with the following:

- A. the laws of the State of Alaska;
- B. the applicable portion of the Federal Civil Rights Act of 1964;
- C. the Equal Employment Opportunity Act and the regulations issued thereunder by the state and federal government;
- D. the Americans with Disabilities Act of 1990 and the regulations issued thereunder by the state and federal government;
- E. the Clean Air and Water Pollution Control Act;
- F. Copeland Anti-Kick Back Act;
- G. Solid Waste Disposal Act;
- H. Clean Water Act;
- I. Contract Work Hours and Safety Standards Act;
- J. Rehabilitation Act of 1973;
- K. Age Discrimination Act of 1976;
- L. Drug Free Workplace Act of 1988;
- M. all terms and conditions set out in this ITB;
- N. the price(s) submitted was arrived at independently arrived and without collusion, under penalty of perjury; and
- O. that the bid will remain open and valid for at least 90 days.

If any bidder fails to comply with [a] through [o] of this paragraph, the state reserves the right to disregard the bid, terminate the contract, or consider the contractor in default.

CONFLICT OF INTEREST

Each bid shall include a statement indicating whether or not the company or any individuals working on the contract has a possible conflict of interest (e.g., currently employed by the State of Alaska or formerly employed by the State of Alaska within the past two years) and, if so, the nature of that conflict. The procurement officer reserves the right to **consider a bid non-responsive and reject it** or cancel the award if any interest disclosed from

any source could either give the appearance of a conflict or cause speculation as to the objectivity of the contract to be performed by the bidder.

SEC. 1.09 PRICES

The bidder shall state prices in the units of issue on this ITB. Prices quoted in bids must be exclusive of federal, state, and local taxes. If the bidder believes that certain taxes are payable by the state, the bidder may list such taxes separately, directly below the bid price for the affected item.

SEC. 1.10 PRE-BID CONFERENCE

A pre-bid teleconference will be held at 10:00 AM, Alaska Time, on March 14, 2022. The purpose of the teleconference is to discuss the work to be performed with prospective bidders and allow them to ask questions concerning the ITB. Bidders should read the ITB in full and come to the meeting prepared to discuss any questions or concerns.

Interested bidders must contact the procurement officer 1 business day in advance so teleconference dial-in information can be provided.

Bidders with a disability needing accommodation should contact the procurement officer prior to the date set for the pre-bid conference so that reasonable accommodation can be made.

SEC. 1.11 ASSISTANCE TO BIDDERS WITH A DISABILITY

Bidders with a disability may receive accommodation regarding the means of communicating this ITB or participating in the procurement process. For more information, contact the procurement officer no later than ten days prior to the deadline for receipt of bids.

SEC. 1.12 AMENDMENTS TO BIDS

Amendments to or withdrawals of bids will only be allowed if acceptable requests are received prior to the deadline that is set for receipt of bids, in accordance with 2 AAC 12.140. No amendments or withdrawals will be accepted after the deadline unless the delay is due to an error of the contracting agency, in accordance with 2 AAC 12.160.

SEC. 1.13 AMENDMENTS TO THE ITB

If an amendment is issued, it will be provided to all who were notified of the ITB and to those who have registered with the procurement officer after receiving the ITB from the State of Alaska Online Public Notice website.

SEC. 1.14 ITB SCHEDULE

The ITB schedule set out herein represents the State of Alaska's best estimate of the schedule that will be followed. If a component of this schedule, such as the deadline for receipt of bids, is delayed, the rest of the schedule may be shifted accordingly. All times are Alaska Time.

ACTIVITY	TIME	DATE
Issue Date / ITB Released	N/A	3/9/2022
Pre-Bid Conference	10:00 AM	3/14/2022

Deadline for Receipt of Bids / Bid Due Date	2:00 PM	3/30/2022
Bid Evaluations Complete	N/A	3/31/2022
Notice of Intent to Award	N/A	4/1/2022
Contract Issued	N/A	4/12/2022

This ITB does not, by itself, obligate the state. The state's obligation will commence when the contract is approved by the Commissioner of the Department of Environmental Conservation, or the Commissioner's designee. Upon written notice to the contractor, the state may set a different starting date for the contract. The state will not be responsible for any work done by the contractor, even work done in good faith, if it occurs prior to the contract start date set by the state.

SEC. 1.15 ALTERNATE BIDS

Bidders may only submit one bid for evaluation. In accordance with 2 AAC 12.830 alternate bids (bids that offer something different than what is asked for) will be rejected.

SEC. 1.16 SUPPORTING INFORMATION

Bidders shall submit all required technical, specification, and other supporting information with their bid, so that a detailed analysis and determination can be made by the procurement officer that the product offered meets the ITB specifications and that other requirements of the ITB have been met. However, provided a bid meets the requirements for a definite, firm, unqualified, and unconditional offer, the state reserves the right to request supplemental information from the bidder, after the bids have been opened, to ensure that the products or services offered completely meet the ITB requirements. The requirement for such supplemental information will be at the reasonable discretion of the state and may include the requirement that a bidder will provide a sample product(s) so that the state can make a first-hand examination and determination.

A bidder's failure to provide this supplemental information or the product sample(s), within the time set by the state, will cause the state to consider the offer non-responsive and reject the bid.

SEC. 1.17 FIRM, UNQUALIFIED, AND UNCONDITIONAL OFFER

Bidders must provide enough information with their bid to constitute a definite, firm, unqualified and unconditional offer. To be responsive a bid must constitute a definite, firm, unqualified and unconditional offer to meet all the material terms of the ITB. Material terms are those that could affect the price, quantity, quality, or delivery. Also included as material terms are those which are clearly identified in the ITB and which, for reasons of policy, must be complied with at risk of bid rejection for non-responsiveness.

SECTION 2. CONTRACT INFORMATION

SEC. 2.01 CONTRACT TERM

The length of the contract will be from the date of award, approximately April 12, 2022, until the items are received.

SEC. 2.02 CONTRACT ADMINISTRATION

The administration of this contract is the responsibility of the procurement officer or person appointed by the Department of Environmental Conservation, Division of Administrative Services.

SEC. 2.03 CONTRACT FUNDING

Payment for the contract is subject to funds already appropriated and identified.

SEC. 2.04 CONTRACT EXTENSION

Unless otherwise provided in this ITB, the state and the successful bidder/contractor agree: (1) that any extension of the contract excluding any exercised renewal options, will be considered as a month-to-month extension, and all other terms and conditions shall remain in full force and effect and (2) the procurement officer will provide written notice to the contractor of the intent to cancel the month-to-month extension at least thirty (30) days before the date of cancellation. A month-to-month extension may only be executed by the procurement officer via a written contract amendment.

SEC. 2.05 CONTRACT CHANGES – UNANTICIPATED AMENDMENTS

During the course of this contract, the contractor may be required to perform additional work. That work will be within the general scope of the initial contract. When additional work is required, the state will provide the contractor a written description of the additional work and request the contractor to submit a firm time schedule for accomplishing the additional work and a firm price for the additional work. Cost and pricing data must be provided to justify the cost of such amendments per AS 36.30.400.

The contractor will not commence additional work until the procurement officer has secured required state approvals necessary for the amendment and issued a written contract amendment.

SEC. 2.06 SUBCONTRACTORS

Subcontractors may be used to perform work under this contract. If a bidder intends to use subcontractors, the bidder must identify in the bids the names of the subcontractors and the portions of the work the subcontractors will perform.

If a bid with subcontractors is selected, the bidder must provide the following information concerning each prospective subcontractor within five working days from the date of the state's request:

- complete name of the subcontractor;
- complete address of the subcontractor;
- type of work the subcontractor will be performing;

- percentage of work the subcontractor will be providing;
- evidence that the subcontractor holds a valid Alaska business license; and
- a written statement signed by each proposed subcontractor that clearly verifies that the subcontractor is committed to render the services required by the contract.

A bidder's failure to provide this information, within the time set, may cause the state to consider their bid non-responsive and reject it.

Note that if the subcontractor will not be performing work within Alaska, they will not be required to hold an Alaska business license.

SEC. 2.07 JOINT VENTURES

Joint ventures will not be allowed.

SEC. 2.08 CONTRACT PERFORMANCE LOCATION

The location(s) the work is to be performed, completed and managed is in the State of Alaska.

The state will not provide workspace for the contractor. The contractor must provide its own workspace.

By signature on their bid, the bidder certifies that all services provided under this contract by the contractor and all subcontractors shall be performed in the United States.

If the bidder cannot certify that all work will be performed in the United States, the bidder must contact the procurement officer in writing to request a waiver at least 10 days prior to the deadline for receipt of bids.

The request must include a detailed description of the portion of work that will be performed outside the United States, where, by whom, and the reason the waiver is necessary.

Failure to comply with these requirements may cause the state to reject the bid as non-responsive, or cancel the contract.

SEC. 2.09 RIGHT TO INSPECT PLACE OF BUSINESS

At reasonable times, the state may inspect those areas of the contractor's place of business that are related to the performance of a contract. If the state makes such an inspection, the contractor must provide reasonable assistance.

SEC. 2.10 SCOPE OF WORK AND SPECIFICATIONS

1. Firm Order: This Invitation to Bid (ITB) is for the one time purchase of various types of pipe and associated quantities defined in the bid schedule. Bidders must enter a price for all items on the bid schedule to be considered responsive. Bid schedule items must meet the attached specifications. Do not include the cost of shipping in the item unit cost. Enter shipping cost as a separate lump sum in the area specified on the bid schedule.
2. Non-mandatory As-needed Order: If the awarded bidder has indicated on the bid schedule that they are able to hold unit prices firm until the date the bidder enters on the bid schedule then the department has

sole discretion to purchase additional as-needed quantities at the unit bid price until that date. The department does not guarantee a minimum order. The department may choose to conduct a new solicitation for the same items specified in this ITB.

SEC. 2.11 F.O.B. POINT

1. Firm Order: The F.O.B. point for this ITB will be Unalakleet, Alaska. The contractor will be required to prepare the items for shipping and to ship them to the ultimate destination specified in the state's order. The contractor will be required to prepay the freight charges from the F.O.B. point to the ultimate destination. The contractor may charge-back the freight charges from the F.O.B. point to the ultimate destination as a separate item on the state's invoice. These costs must be billed as a pass-through charge.
2. Non-mandatory As-needed Orders: The cost of shipping and delivery for as-needed orders will be handled as follows. The contractor will find the most cost effective shipping price to the F.O.B. Point for the department's review. If the department accepts the shipping cost the department will include the shipping cost on the order. The contractor will prepay the shipping and delivery charges to any destination named by the state in its order. The contractor will charge-back those shipping and delivery charges to the state as a separate item on the state's invoice. These charges must be billed as a pass-through charge.

SEC. 2.12 SHIPPING DAMAGE

The state will not accept or pay for damaged goods. The contractor must file all claims against the carrier(s) for damages incurred to items in transit from the point of origin to the ultimate destination. The state will provide the contractor with written notice when damaged goods are received. The state will deduct the cost of the damaged goods from the invoice prior to payment. The contractor must file all claims against the carrier(s) for reimbursement of the loss.

SEC. 2.13 DELIVERY TIME

1. Firm Order: Delivery of all items must be completed in calendar year 2022. The department will accept partial orders throughout 2022. June 1, 2022 is the earliest pipe can be installed and the department wants to start this process as soon as possible.
2. Non-mandatory As-needed Orders: If the department purchases additional quantities, the department will work with the contractor to determine an acceptable delivery time that the department will specify on the purchase order. The department is not obligated to issue a purchase order if the department determines the delivery time is not acceptable to the department.

SEC. 2.14 INSPECTION & MODIFICATION - REIMBURSEMENT FOR UNACCEPTABLE DELIVERABLES

The contractor is responsible for providing all products or the completion of all work set out in the contract. All products or work is subject to inspection, evaluation, and approval by the state. The state may employ all reasonable means to ensure that the work is progressing and being performed in compliance with the contract. The state may instruct the contractor to make corrections or modifications if needed in order to accomplish the contract's intent. The contractor will not unreasonably withhold such changes.

Substantial failure of the contractor to perform the contract may cause the state to terminate the contract. In this event, the state may require the contractor to reimburse monies paid (based on the identified portion of unacceptable products or work received) and may seek associated damages.

SEC. 2.15 CONTINUING OBLIGATION OF CONTRACTOR

Notwithstanding the expiration date of a contract resulting from this ITB, the contractor is obligated to fulfill its responsibilities until warranty, guarantee, maintenance, and parts availability requirements have completely expired.

SEC. 2.16 ESTIMATED QUANTITIES

The department does not have estimated quantities.

SEC. 2.17 CONTRACT PRICE ADJUSTMENTS

Section not used.

SEC. 2.18 INFORMAL DEBRIEFING

When the contract is completed, an informal debriefing may be performed at the discretion of the procurement officer. If performed, the scope of the debriefing will be limited to the products provided or work performed by the contractor.

SEC. 2.19 INDEMNIFICATION

The contractor shall indemnify, hold harmless, and defend the contracting agency from and against any claim of, or liability for error, omission or negligent act of the contractor under this agreement. The contractor shall not be required to indemnify the contracting agency for a claim of, or liability for, the independent negligence of the contracting agency. If there is a claim of, or liability for, the joint negligent error or omission of the contractor and the independent negligence of the contracting agency, the indemnification and hold harmless obligation shall be apportioned on a comparative fault basis.

“Contractor” and “contracting agency”, as used within this and the following article, include the employees, agents and other contractors who are directly responsible, respectively, to each. The term “independent negligence” is negligence other than in the contracting agency’s selection, administration, monitoring, or controlling of the contractor and in approving or accepting the contractor’s work.

SEC. 2.20 INSURANCE

Without limiting the contractor's indemnification, it is agreed that the contractor shall purchase at its own expense and maintain in force at all times during the performance of services under this agreement the following policies of insurance. Where specific limits are shown, it is understood that they shall be the minimum acceptable limits. If the contractor's policy contains higher limits, the state shall be entitled to coverage to the extent of such higher limits.

Certificates of Insurance must be furnished to the procurement officer prior to contract approval and must provide for a notice of cancellation, non-renewal, or material change of conditions in accordance with policy provisions. Failure to furnish satisfactory evidence of insurance or lapse of the policy is a material breach of this contract and

shall be grounds for termination of the contractor's services. All insurance policies shall comply with and be issued by insurers licensed to transact the business of insurance under AS 21.

Proof of insurance is required for the following:

- Workers' Compensation Insurance: The contractor shall provide and maintain, for all employees engaged in work under this contract, coverage as required by AS 23.30.045, and; where applicable, any other statutory obligations including but not limited to Federal U.S.L. & H. and Jones Act requirements. The policy must waive subrogation against the state.
- Commercial General Liability Insurance: covering all business premises and operations used by the contractor in the performance of services under this agreement with minimum coverage limits of \$300,000 combined single limit per occurrence.
- Commercial Automobile Liability Insurance: covering all vehicles used by the contractor in the performance of services under this agreement with minimum coverage limits of \$300,000 combined single limit per occurrence.

SEC. 2.21 MANDATORY REPORTING

Section not used.

SECTION 3. CONTRACT INVOICING AND PAYMENTS

SEC. 3.01 BILLING INSTRUCTIONS

Invoices must be billed to the ordering agency's address shown on the individual Purchase Order, Contract Award or Delivery Order. The state will make payment after it receives the goods or services and the invoice. Questions concerning payment must be addressed to the ordering agency.

SEC. 3.02 PAYMENT FOR STATE PURCHASES

Payment for agreements under \$500,000 for the undisputed purchase of goods or services provided to a state agency, will be made within 30 days of the receipt of a proper billing or the delivery of the goods or services to the location(s) specified in the agreement, whichever is later. A late payment is subject to 1.5% interest per month on the unpaid balance. Interest will not be paid if there is a dispute or if there is an agreement that establishes a lower interest rate or precludes the charging of interest.

Any single contract payments of \$1 million or higher must be accepted by the contractor via Electronic Funds Transfer (EFT).

SEC. 3.03 PROMPT PAYMENT FOR STATE PURCHASES

Section not used.

SEC. 3.04 THIRD-PARTY FINANCING AGREEMENTS NOT ALLOWED

Because of the additional administrative and accounting time required of the state when third party financing agreements are permitted, they will not be allowed under this contract.

SECTION 4. EVALUATION AND CONTRACTOR SELECTION

SEC. 4.01 EVALUATION OF BIDS

After bid opening, the procurement officer will evaluate the bids for responsiveness. Bids deemed non-responsive will be eliminated from further consideration. An evaluation may not be based on discrimination due the race, religion, color, national origin, sex, age, marital status, pregnancy, parenthood, disability, or political affiliation of the bidder.

SEC. 4.02 MBE / WBE PREFERENCE

A Minority Business Enterprise (MBE) or Women's Business Enterprise (WBE) preference of 5% will be applied to the total bid price. To receive the points, the qualified MBE / WBE bidder must provide evidence of certification and the work that they shall perform.

This procurement is funded in part or fully through federal grants or cooperative agreements. It is a national policy to award a fair share of contracts to Minority Firms and Women's Business Enterprises through affirmative action. This solicitation incorporates a five-point preference for all qualified minority firms and women's business enterprises.

In order to be deemed a bona fide MBE / WBE a firm must be an independent business concern which is at least fifty-one percent (51%) owned and controlled by minority group members or women.

SEC. 4.03 MBE / WBE CERTIFICATION

In order to qualify for the Women's Business Enterprises (WBE) or Minority Business Enterprises (MBE), the business must obtain certification from any of the following organizations:

- United States Small Business Administration,
- United States Department of Transportation,
- Indian Tribal Governments,
- State/local Governments,
- Independent private organizations.

To qualify for the federal Environmental Protection Association, Disadvantaged Business Enterprises program, an entity must be certified, and such certification must meet the criteria as stipulated in 40 CFR §33.202 and/or §33.203.

Offerors may provide their MBE/WBE certification number on the proposal form. If a certification number is not available, then the offeror must provide a letter from the certifying agency verifying the offerors certification status.

SEC. 4.04 APPLICATION OF PREFERENCES

Section not used.

SEC. 4.05 ALASKA BIDDER PREFERENCE

Section not used.

SEC. 4.06 ALASKA VETERAN PREFERENCE

Section not used.

SEC. 4.07 USE OF LOCAL FOREST PRODUCTS

Section not used.

SEC. 4.08 LOCAL AGRICULTURAL AND FISHERIES PRODUCT PREFERENCE

Section not used.

SEC. 4.09 ALASKA PRODUCT PREFERENCE

Section not used.

SEC. 4.10 EMPLOYMENT PROGRAM PREFERENCE

Section not used.

SEC. 4.11 ALASKANS WITH DISABILITIES PREFERENCE

Section not used.

SEC. 4.12 PREFERENCE QUALIFICATION LETTER

Section not used.

SEC. 4.13 EXTENSION OF PRICES

In case of error in the extension of prices in the bid, the unit prices will govern; in a lot bid, the lot prices will govern.

SEC. 4.14 METHOD OF AWARD

Award will be made to the lowest responsive and responsible bidder. In order to be considered responsive, bidders must bid on all items.

SEC. 4.15 CONTRACTOR SELECTION PROCESS

Section not used.

SEC. 4.16 NOTICE OF INTENT TO AWARD

After the responses to this ITB have been opened and evaluated, a tabulation of the bids will be prepared. This tabulation, called a Notice of Intent to Award, serves two purposes. It lists the name of each company or person that offered a bid and the price they bid. It also provides notice of the state's intent to award a contract(s) to the bidder(s) indicated. A copy of the Notice of Intent will be mailed to each company or person who responded to the ITB. Bidders identified as the apparent low responsive bidders are instructed not to proceed until a Purchase

Order, Contract Award, Lease, or some other form of written notice is given by the procurement officer. A company or person who proceeds prior to receiving a Purchase Order, Contract Award, Lease, or some other form of written notice from the procurement officer does so without a contract and at their own risk.

SECTION 5. GENERAL PROCESS AND LEGAL INFORMATION

SEC. 5.01 ALASKA BUSINESS LICENSE AND OTHER REQUIRED LICENSES

Prior to the award of a contract, a bidder must hold a valid Alaska business license. However, in order to receive the Alaska Bidder Preference and other related preferences, such as the Alaska Veteran Preference and Alaskans with Disabilities Preference, a bidder must hold a valid Alaska business license prior to the deadline for receipt of bids. Bidders should contact the **Department of Commerce, Community and Economic Development, Division of Corporations, Business, and Professional Licensing, PO Box 110806, Juneau, Alaska 99811-0806**, for information on these licenses. Acceptable evidence that the bidder possesses a valid Alaska business license may consist of any one of the following:

- copy of an Alaska business license;
- certification on the bid that the bidder has a valid Alaska business license and has included the license number in the bid;
- a canceled check for the Alaska business license fee;
- a copy of the Alaska business license application with a receipt stamp from the state's occupational licensing office; or
- a sworn and notarized statement that the bidder has applied and paid for the Alaska business license.

You are not required to hold a valid Alaska business license at the time bids are opened if you possess one of the following licenses and are offering services or supplies under that specific line of business:

- fisheries business licenses issued by Alaska Department of Revenue or Alaska Department of Fish and Game,
- liquor licenses issued by Alaska Department of Revenue for alcohol sales only,
- insurance licenses issued by Alaska Department of Commerce, Community and Economic Development, Division of Insurance, or
- Mining licenses issued by Alaska Department of Revenue.

Prior the deadline for receipt of bids, all bidders must hold any other necessary applicable professional licenses required by Alaska Statute.

SEC. 5.02 AUTHORITY

This ITB is written in accordance with AS 36.30 and 2 AAC 12.

SEC. 5.03 COMPLIANCE

In the performance of a contract that results from this ITB, the contractor must comply with all applicable federal, state, and borough regulations, codes, and laws; be liable for all required insurance, licenses, permits and bonds; and pay all applicable federal, state, and borough taxes.

SEC. 5.04 SUITABLE MATERIALS, ETC.

Unless otherwise specified in this ITB, all materials, supplies or equipment offered by a bidder shall be new, unused, and of the latest edition, version, model or crop and of recent manufacture.

SEC. 5.05 SPECIFICATIONS

Unless otherwise specified in this ITB, product brand names or model numbers specified in this ITB are examples of the type and quality of product required, and are not statements of preference. If the specifications describing an item conflict with a brand name or model number describing the item, the specifications govern. Reference to brand name or number does not preclude an offer of a comparable or better product, if full specifications and descriptive literature are provided for the product. Failure to provide such specifications and descriptive literature may be cause for rejection of the offer.

SEC. 5.06 CONTRACTOR SITE INSPECTION

The state may conduct on-site visits to evaluate the bidder's capacity to perform the contract. A bidder must agree, at risk of being found non-responsive and having its bid rejected, to provide the state reasonable access to relevant portions of its work sites. Individuals designated by the procurement officer at the state's expense will make site inspection.

SEC. 5.07 ORDER DOCUMENTS

Except as specifically allowed under this ITB, an ordering agency will not sign any vendor contract. The state is not bound by a vendor contract signed by a person who is not specifically authorized to sign for the state under this ITB. Unless otherwise specified in this ITB, the State of Alaska Purchase Order, Contract Award and Delivery Order are the only order documents that may be used to place orders against the contract(s) resulting from this ITB.

SEC. 5.08 HUMAN TRAFFICKING

By signature on their bid, the bidder certifies that the bidder is not established and headquartered or incorporated and headquartered in a country recognized as Tier 3 in the most recent United States Department of State's Trafficking in Persons Report.

The most recent United States Department of State's Trafficking in Persons Report can be found at the following website: <http://www.state.gov/j/tip/>

Failure to comply with this requirement will cause the state to reject the bid as non-responsive, or cancel the contract.

SEC. 5.09 RIGHT OF REJECTION

Bidders must comply with all of the terms of the ITB, the State Procurement Code (AS 36.30), and all applicable local, state, and federal laws, codes, and regulations. The procurement officer may reject any bid that does not comply with all of the material and substantial terms, conditions, and performance requirements of the ITB.

Bidders may not qualify the bid nor restrict the rights of the state. If a bidder does so, the procurement officer may determine the bid to be a non-responsive counter-offer and the bid may be rejected.

Minor informalities that:

- do not affect responsiveness;
- are merely a matter of form or format;
- do not change the relative standing or otherwise prejudice other offers;
- do not change the meaning or scope of the RFP;
- are trivial, negligible, or immaterial in nature;
- do not reflect a material change in the work; or
- do not constitute a substantial reservation against a requirement or provision;

may be waived by the procurement officer.

The state reserves the right to refrain from making an award if it determines that to be in its best interest.

A bid from a debarred or suspended bidder shall be rejected.

SEC. 5.10 STATE NOT RESPONSIBLE FOR PREPARATION COSTS

The state will not pay any cost associated with the preparation, submittal, presentation, or evaluation of any bid.

SEC. 5.11 DISCLOSURE OF BID CONTENTS

All bid prices become public information at the bid opening. After the deadline for receipt of bids, all other bid material submitted become the property of the State of Alaska and may be returned only at the state's option. AS 40.25.110 requires public records to be open to reasonable inspection. All other bid information will be held in confidence during the evaluation process and prior to the time a Notice of Intent to Award is issued. Thereafter, bids will become public information.

The Office of Procurement and Property Management (OPPM), or their designee recognizes that some information an offeror submits might be confidential under the United States or the State of Alaska Constitution, a federal statute or regulation, or a State of Alaska statute: i.e., might be confidential business information (CBI). *See, e.g.*, article 1, section 1 of the Alaska Constitution; AS 45.50.910 – 45.50.945 (the Alaska Uniform Trade Secrets Act); *DNR v. Arctic Slope Regional Corp.*, 834 P.2d 134, 137-39 (Alaska 1991). For OPPM or their designee to treat information an offeror submits with its proposal as CBI, the offeror must do the following when submitting their proposal: (1) mark the specific information it asserts is CBI; and (2) for each discrete set of such information, identify, in writing, each authority the offeror asserts make the information CBI. If the offeror does not do these things, the information will become public after the Notice of Intent to Award is issued. If the offeror does these things, OPPM or their designee will evaluate the offeror's assertion upon receiving a request for the information. If OPPM or their designee reject the assertion, they will, to the extent permitted by federal and State of Alaska law, undertake reasonable measures to give the offeror an opportunity to object to the disclosure of the information.

SEC. 5.12 ASSIGNMENTS

Per 2 AAC 12.480, the contractor may not transfer or assign any portion of the contract without prior written approval from the procurement officer. Bids that are conditioned upon the state's approval of an assignment will be rejected as non-responsive.

SEC. 5.13 FORCE MAJEURE (IMPOSSIBILITY TO PERFORM)

The parties to a contract resulting from this ITB are not liable for the consequences of any failure to perform, or default in performing, any of its obligations under the contract, if that failure or default is caused by any unforeseeable Force Majeure, beyond the control of, and without the fault or negligence of, the respective party.

For the purposes of this ITB, Force Majeure will mean war (whether declared or not); revolution; invasion; insurrection; riot; civil commotion; sabotage; military or usurped power; lightning; explosion; fire; storm; drought; flood; earthquake; epidemic; quarantine; strikes; acts or restraints of governmental authorities affecting the project or directly or indirectly prohibiting or restricting the furnishing or use of materials or labor required; inability to secure materials, machinery, equipment or labor because of priority, allocation or other regulations of any governmental authorities.

SEC. 5.14 DEFAULT

In case of default by the contractor, for any reason whatsoever, the state may procurement the goods or services from another source and hold the contractor responsible for any resulting excess cost and may seek other remedies under law or equity.

SEC. 5.15 DISPUTES

If the contractor has a claim arising in connection with the contract that it cannot resolve with the state by mutual agreement, it shall pursue the claim, if at all, in accordance with the provisions of AS 36.30.620 – AS 36.30.632.

SEC. 5.16 SEVERABILITY

If any provision of the contract or agreement is found to be invalid or declared by a court to be illegal or in conflict with any law, the validity of the remaining terms and provisions will not be affected; and, the rights and obligations of the parties will be construed and enforced as if the contract did not contain the particular provision held to be invalid.

SEC. 5.17 CONTRACT CANCELLATION

The state reserves the right to cancel the contract at its convenience upon 10 calendar days written notice to the contractor. The state is only liable for payment in accordance with the payment provisions of this contract for supplies or services provide before the effective date termination.

SEC. 5.18 GOVERNING LAW; FORUM SELECTION

A contract resulting from this ITB is governed by the laws of the State of Alaska. To the extent not otherwise governed by Section 5.15 of this ITB, any claim concerning the contract shall be brought only in the Superior Court of the State of Alaska and not elsewhere.

SEC. 5.19 SOLICITATION ADVERTISING

Public notice has been provided in accordance with 2 AAC 12.220.

SEC. 5.20 QUALIFIED BIDDERS

Per 2 AAC 12.875, unless provided for otherwise in the ITB, to qualify as a bidder for award of a contract issued under AS 36.30, the bidder must:

- 1) Add value in the contract by actually performing, controlling, managing, or supervising the services to be provided; or
- 2) Be in the business of selling and have actually sold on a regular basis the supplies that are the subject of the ITB.

If the bidder leases services or supplies or acts as a broker or agency in providing the services or supplies in order to meet these requirements, the procurement officer may not accept the bidder as a qualified bidder under AS 36.30.

SEC. 5.21 FEDERALLY IMPOSED TARIFFS

Changes in price (increase or decrease) resulting directly from a new or updated federal tariff, excise tax, or duty, imposed after contract award may be adjusted during the contract period or before delivery into the United States via contract amendment.

- **Notification of Changes:** The contractor must promptly notify the procurement officer in writing of any new, increased, or decreased federal excise tax or duty that may result in either an increase or decrease in the contract price and shall take appropriate action as directed by the procurement officer.
- **After-imposed or Increased Taxes and Duties:** Any federal excise tax or duty for goods or services covered by this contract that was exempted or excluded on the contract award date but later imposed on the contractor during the contract period, as the result of legislative, judicial, or administrative action may result in a price increase provided:
 - a) The tax or duty takes effect after the contract award date and isn't otherwise addressed by the contract;
 - b) The contractor warrants, in writing, that no amount of the newly imposed federal excise tax or duty or rate increase was included in the contract price, as a contingency or otherwise.
- **After-relieved or Decreased Taxes and Duties:** The contract price shall be decreased by the amount of any decrease in federal excise tax or duty for goods or services under the contract, except social security or other employment [taxes](#), that the contractor is required to pay or bear, or does not obtain a refund of, through the contractor's fault, negligence, or failure to follow instructions of the procurement officer.
- **State's Ability to Make Changes:** The state reserves the right to request verification of federal excise tax or duty amounts on goods or services covered by this contract and increase or decrease the contract price accordingly.

- **Price Change Threshold:** No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.

SEC. 5.22 PROTEST

AS 36.30.560 provides that an interested party may protest the content of the ITB.

An interested party is defined in 2 AAC 12.990(a) (7) as "an actual or prospective bidder or offeror whose economic interest might be affected substantially and directly by the issuance of a contract solicitation, the award of a contract, or the failure to award a contract."

If an interested party wishes to protest the content of a solicitation, the protest must be received, in writing, by the procurement officer at least ten days prior to the deadline for receipt of bids.

AS 36.30.560 also provides that an interested party may protest the award of a contract or the proposed award of a contract.

If a bidder wishes to protest the award of a contract or the proposed award of a contract, the protest must be received, in writing, by the procurement officer within ten days after the date the Notice of Intent to Award the contract is issued.

A protester must have submitted a bid in order to have sufficient standing to protest the proposed award of a contract. Protests must include the following information:

- the name, address, and telephone number of the protester;
- the signature of the protester or the protester's representative;
- identification of the contracting agency and the solicitation or contract at issue;
- a detailed statement of the legal and factual grounds of the protest including copies of relevant documents; and the form of relief requested.

Protests filed by telex or telegram are not acceptable because they do not contain a signature. Fax copies containing a signature are acceptable.

The procurement officer will issue a written response to the protest. The response will set out the procurement officer's decision and contain the basis of the decision within the statutory time limit in AS 36.30.580. A copy of the decision will be furnished to the protester by certified mail, fax or another method that provides evidence of receipt.

All bidders will be notified of any protest. The review of protests, decisions of the procurement officer, appeals, and hearings, will be conducted in accordance with the State Procurement Code (AS 36.30), Article 8 "Legal and Contractual Remedies."

SEC. 5.23 WRITTEN DETERMINATIONS

The following is a list of written determinations affecting this solicitation:

1. EPA funds are being utilized for this procurement and grant conditions specify “The recipient agrees to comply with the current EPA general terms and conditions”. The department is excluding State preferences in accordance with 2 CFR 200.319 (c).
2. Section 4.02 MBE / WBE Preference: Federal funds from the Environmental Protection Agency (EPA) are being utilized for this procurement. The department shall comply with the requirements of EPA's Disadvantaged Business Enterprise (DBE) Program for procurement activities under assistance agreements, contained in 40 CFR, Part 33.

SECTION 6. ATTACHMENTS

SEC. 6.01 ATTACHMENTS

Attachments:

- 1) Bid Schedule
- 2) Appendix B
- 3) Appendix C
- 4) 80903.00 Technical Specifications.

BID SCHEDULE

Item	Description	Quantity	Unit	Unit Price	Extended Price
A	6" x 18" high density polyethylene (HDPE) jacketed arctic pipe per specification 33 11 13 and 33 90 10.	13,280	Feet	\$	\$
B	2" standard dimension ratio (SDR) 11 bare HDPE pipe per specification 34 11 13 and 33 90 10.	27,500	Feet	\$	\$
C	6" x 15" HDPE jacketed arctic pipe per specification 35 11 13 and 33 90 10.	320	Feet	\$	\$
D	1-1/4" SDR 11 bare HDPE pipe per specification 36 11 13 and 33 90 10.	500	Feet	\$	\$
E	2" SDR 11 bare HDPE pipe per specification 37 11 13 and 33 90 10.	300	Feet	\$	\$
F	6" x 15" aluminum jacketed arctic pipe per specification 38 11 13 and 33 90 10.	440	Feet	\$	\$
G	6" x 18" aluminum jacketed arctic pipe per specification 39 11 13 and 33 90 10.	240	Feet	\$	\$
H	Shipping to F.O.B. Point	Lump Sum			\$
I	Total Unadjusted Bid Amount (Items A thru H = I)				\$
J	MBE/WBE Preference (5% of I), or blank (\$0) if not applicable.				\$
K	Total Adjusted Bid Amount for evaluation purposes only (I-J = K)				\$

Bidders may complete the following:

Non-mandatory As-needed Order: (see section 2.10): The bidder is able to hold bid item (except shipping) unit costs firm until date [_____].

Federal Debarment Certification Form

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion Lower Tier Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 29 CFR Part 98, Section 98.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160-19211).

(BEFORE COMPLETING CERTIFICATION, READ THE INSTRUCTIONS ON THE FOLLOWING PAGE WHICH ARE AN INTEGRAL PART OF THE CERTIFICATION)

(1) The prospective recipient of Federal assistance funds certifies, by submission of this bid, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective recipient of Federal assistance funds is unable to certify to any of the Statements in this certification, such prospective participant shall attach an explanation to this Proposal.

Name and Title of Authorized Representative

Signature

Date

Federal Debarment Certification Form Instructions

Instructions for Certification

1. By signing and submitting this Proposal, the prospective recipient of Federal assistance funds is providing the certification as set out below.
2. The certification in this class is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective recipient of Federal assistance funds knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the Department of Labor (DOL) may pursue available remedies, including suspension and/or debarment.
3. The prospective recipient of Federal assistance funds shall provide immediate written notice to the person to whom this Proposal is submitted if at any time the prospective recipient of Federal assistance funds learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "Proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this Proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective recipient of Federal assistance funds agrees by submitting this Proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the DOL.
6. The prospective recipient of Federal assistance funds further agrees by submitting this Proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may but is not required to check the List of Parties Excluded from Procurement or Non-procurement Programs.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the DOL may pursue available remedies, including suspension and/or debarment.

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents of all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly. The contractor and any subcontractors must return this completed certification form to the contract administering office.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, United States Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Organization: _____

Street address: _____

City, State, Zip: _____

CERTIFIED BY: (Type or Print)

TITLE:

(signature)

(date)

FAR 52.203-11**CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (SEPT 2007)** (a) *Definitions*. As used in this provision—"Lobbying contact" has the meaning provided at [2](#)

[U.S.C. 1602\(8\)](#). The terms "agency," "influencing or attempting to influence," "officer or employee of an agency," "person," "reasonable compensation," and "regularly employed" are defined in the FAR clause of this solicitation entitled "Limitation on Payments to Influence Certain Federal Transactions" ([52.203-12](#)).

(b) *Prohibition*. The prohibition and exceptions contained in the FAR clause of this solicitation entitled "Limitation on Payments to Influence Certain Federal Transactions" ([52.203-12](#)) are hereby incorporated by reference in this provision.

(c) *Certification*. The offeror, by signing its offer, hereby certifies to the best of its knowledge and belief that no Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on its behalf in connection with the awarding of this contract.

(d) *Disclosure*. If any registrants under the Lobbying Disclosure Act of 1995 have made a lobbying contact on behalf of the offeror with respect to this contract, the offeror shall complete and submit, with its offer, OMB Standard Form LLL, Disclosure of Lobbying Activities, to provide the name of the registrants. The offeror need not report regularly employed officers or employees of the offeror to whom payments of reasonable compensation were made.

(e) *Penalty*. Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by [31 U.S.C. 1352](#). Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure required to be filed or amended by this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

CONSENT TO USE OF ELECTRONIC SIGNATURES

BY CHECKING HERE, I AGREE TO THE USE OF ELECTRONIC SIGNATURES AS VALID, LEGALLY BINDING SUBSTITUTES FOR ORIGINAL, HANDWRITTEN SIGNATURES ON THIS DOCUMENT.

Company _____

Name (signature) _____

Name (printed) _____

Title _____ Date of execution _____

DISCLOSURE OF LOBBYING ACTIVITIES

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352

Approved by OMB

0348-0046

(See reverse for public burden disclosure.)

1. Type of Federal Action: <input type="checkbox"/> a. contract <input type="checkbox"/> b. grant <input type="checkbox"/> c. cooperative agreement <input type="checkbox"/> d. loan <input type="checkbox"/> e. loan guarantee <input type="checkbox"/> f. loan insurance		2. Status of Federal Action: <input type="checkbox"/> a. bid/offer/application <input type="checkbox"/> b. initial award <input type="checkbox"/> c. post-award		3. Report Type: <input type="checkbox"/> a. initial filing <input type="checkbox"/> b. material change For Material Change Only: year _____ quarter _____ date of last report _____	
4. Name and Address of Reporting Entity: <input type="checkbox"/> Prime <input type="checkbox"/> Subawardee Tier _____, if known: Congressional District, if known:			5. If Reporting Entity in No. 4 is a Subawardee, Enter Name and Address of Prime: Congressional District, if known:		
6. Federal Department/Agency:			7. Federal Program Name/Description: CFDA Number, if applicable: _____		
8. Federal Action Number, if known:			9. Award Amount, if known: \$ _____		
10. a. Name and Address of Lobbying Registrant (if individual, last name, first name, MI):			b. Individuals Performing Services (including address if different from No. 10a) (last name, first name, MI):		
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.			Signature: _____ Print Name: _____ Title: _____ Telephone No.: _____ Date: _____		
Federal Use Only:				Authorized for Local Reproduction Standard Form LLL (Rev. 7-97)	

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.

(b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503.

**Issued for Agency Review
Technical Specifications**

For

**UNALAKLEET, ALASKA
WATER SOURCE**

OWNER: City of Unalakleet
P.O. Box 28
Unalakleet, AK 99684

ENGINEER: CRW Engineering Group, LLC
3940 Arctic Boulevard, Suite 300
Anchorage, Alaska 99503

June 2021

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DRAWINGS (under separate cover)

Unalakleet, Alaska
Water Source (Issued for Agency Review)
June 2021

Project: 80903.00 Unalakleet Water Source
 Bid Schedule

Item	Description	QTY	Unit	Unit Price	Extended Total Amount
1	Mobilization	1	LS		
2	Construction Survey	1	LS		
3	Erosion and Pollution Control	1	LS		
4	Water Treatment Plant Upgrades	1	LS		
5	6x15 Raw Water Service Line	850	LF		
6	6x18 Below-Grade Raw Water Main	12270	LF		
7	6x18 Above-Grade Raw Water Main	460	LF		
8	Resurface Public Roadway (Gravel)	8600	LF		
9	Resurface Public Roadway (AC Pavement)	3140	SY		
10	Wellhouse Enclosures	5	EA		
11	Access Road	2010	LF		
12	Culverts	3	EA		
13	Wellfield Power Distribution System	1	LS		

Project Total _____

DIVISION 01 GENERAL REQUIREMENTS

**SECTION 01 00 00
GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. See specification Section 01 10 00, SUMMARY

1.2 EXTRA OR DISPUTED WORK REPORTS

- A. If payment for work performed is to be based on time and materials, or if a claim is contemplated in which time and material reports would assist in settling the claim, the Contractor shall maintain adequate records on the Daily Report forms available from the Engineer. The reported work shall have the Engineer's and/or Resident Project Representative's signature to indicate his concurrence prior to being submitted to the Engineer or Contract Administrator within 48 hours of the time the work was performed. Concurrence by the Resident Project Representative does not indicate agreement to or authorization of "extra work" or "extra payment" but rather indicates agreement that the work effort recorded during that time period was in fact done.

1.3 MATERIAL TESTING AND INSPECTION

- A. Contractor's Obligation
1. The Contractor shall obtain and pay for all testing that may be necessary to qualify Contractor-furnished materials for use in the work. This shall include material quality tests, mix designs, equipment and plant calibration, and other similar tests required to qualify Contractor-furnished materials for compliance with the specifications. The Contractor shall submit test results to the Engineer sufficiently in advance of the work so that approval to proceed is received by the Contractor prior to using that material in the work.
 2. Samples of material required for testing shall be furnished by the Contractor.
 3. The Contractor is responsible for coordinating with the Resident Project Representative and requesting all testing, including field testing paid for by the Owner.
 4. The Contractor shall pay for all failing field tests performed to monitor construction control of the materials used in the work.
 5. Payment for failing field tests will be deducted from any amounts due or to become due to the Contractor.
- B. Owner's Obligation
1. The Owner will be paying for a Resident Project Representative, if any, to be onsite during the construction.

C. WEATHER LIMITATIONS

1. The Contractor shall protect each increment of completed work against detrimental effects due to weather, by approved methods. Any increment of completed work that is damaged by freezing or rain, shall be reconditioned, reshaped, re-compacted, or replaced by the Contractor in conformance with the requirements of this specification without additional cost to the Owner.

D. NOTICE TO BE GIVEN

1. Contractor shall notify the Engineer's Resident Project Representative at least 24 hours prior to the following:
 - a. Disruptions in water service
 - b. Testing

END OF SECTION

SECTION 01 10 00 SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Contract description.
 - 2. Work by Owner or other Work at the Site.
 - 3. Contractor's use of Site and premises.
 - 4. Work sequence.
 - 5. Owner occupancy.
 - 6. Permits.
 - 7. Specification conventions.

1.2 CONTRACT DESCRIPTION

- A. Construction a new community water source, including:
 - 1. Construction of new well access roads and well pads.
 - 2. Construction of new well-head enclosures.
 - 3. Construction of a new electrical power distribution system to power the wells.
 - 4. Construction of a new primarily below-grade raw water transmission line.
 - 5. Mechanical, electrical and treatment process upgrades to the water treatment plant.
- B. Perform Work of the Contract under stipulated sum in accordance with the Contract with Owner according to Conditions of Contract.

1.3 WORK BY OWNER OR OTHERS

- A. If Owner-awarded contracts interfere with each other due to work being performed at the same time or at the same Site, Owner will determine the sequence of work under all contracts according to "Work Sequence" and "Contractor's Use of Site and Premises" Articles in this Section.
- B. Coordinate Work with utilities of Owner and public or private agencies.
- C. Any items noted NIC (Not in Contract), will be furnished and installed by Owner after construction of the proposed improvements.
- D. Remove and deliver to Owner the following items before completion of Work:
 - 1. Materials to be salvaged per the Drawings and/or elsewhere in the Specifications.

1.4 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Limit use of Water Treatment Plant and Work in public rights-of-way and private facilities to allow:
 - 1. Occupancy by Owner.
 - 2. Work by Owner.
 - 3. Work by Others.
 - 4. Public Access (in public rights-of-way only)
 - 5. Occupancy by facility owners.
- B. Access to Site by Owner personnel to operate and maintain the water treatment plant, and water distribution facilities.
- C. Emergency Building Exits during Construction: Maintain access at all times.
- D. Construction Operations: Limited to areas indicated on Drawings.
 - 1. Noisy and Disruptive Operations (such as use of welding equipment, saws, and other equipment that can inhibit proper operations):
 - a. Not allowed inside existing building during regular hours of operation. Coordinate and schedule such operations with Owner to minimize disruptions.
 - b. Only allowed between 8:00 AM and 8:00 PM in public rights-of-way and private residences.
 - 2. Coordinate and schedule access to private facilities with Owner, and property occupant to minimize disruptions. Coordinate access a minimum of 7 days in advance of proposed construction schedule date and adjust as necessary to maintain overall construction progress.
- E. Utility Outages and Shutdown:
 - 1. Coordinate and schedule electrical and other utility outages with Owner.
 - 2. Outages: Allowed only at previously agreed upon times.
 - 3. At least one week before scheduled outage, submit Outage Request Plan to Engineer itemizing the dates, times, and duration of each requested outage.
- F. Construction Plan: Before start of construction, submit an electronic copy of construction plan regarding access to Work, use of Site, and utility outages for acceptance by Owner. After acceptance of plan, construction operations shall comply with accepted plan unless deviations are accepted by Owner in writing.

1.5 WORK SEQUENCE

- A. Sequencing of Construction Plan: Before start of construction, submit three copies of construction plan regarding phasing of demolition, renovation, and new Work for acceptance by Owner. After acceptance of plan, construction sequencing shall comply with accepted plan unless deviations are accepted by Owner in writing. Scheduling constraints are as follows:

1. Water distribution service must remain in operation at all times throughout construction except for approved shutdowns. Full system shutdowns will be scheduled for off peak hours (10:00 PM to 5:00 AM) and will be a maximum of six hours in duration.
 2. The Water Treatment Plant must remain in operation when raw water is supplied from Powers Creek.
 3. Once the new wellfield and raw water transmission line are online, started, tested, disinfected, and commissioned, water from the new wellfield can be pumped to the water storage tank, bypassing the filters. Chlorine injection must be maintained when the filters are bypassed.
- B. Facility Operations:
1. Continuous operation of Owner's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.
 2. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of Owner's operations.
 3. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner.
- C. Coordinate construction sequence and operations with Engineer.

1.6 OWNER OCCUPANCY

- A. Schedule and substantially complete designated portions of the Work for occupancy before Substantial Completion of the entire Work as required to meet sequencing requirements identified in Article 1.5 above.
- B. Owner will occupy WTP premises during entire period of construction to conduct normal operations and maintenance of existing facilities.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

1.7 PERMITS

- A. The following permits will be secured by Owner:
1. ADEC Approval to Construct
 2. Fire Marshall Plan Review
- B. Contractor shall furnish all necessary temporary permits for construction of Work, including the following:
1. Contained Water Discharge Permit (ADEC)

2. Storm Water Pollution Prevention Plan (SWPPP) (ADEC)
3. Any other permits required for construction.

1.8 SPECIFICATION CONVENTIONS

- A. These Specifications are written in imperative mood and streamlined form. This imperative language is directed to Contractor unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

**SECTION 01 22 00
UNIT PRICES**

PART 1 - GENERAL

1.1 ESTIMATED QUANTITIES

- A. The estimated quantities shown in the Bid Form are estimates only, being given only as the basis for the comparison of Bids, and the Owner does not warrant, expressly or by implication, that the actual amount of work will correspond therewith.
- B. The right to increase or decrease the amount of any class or portion of the work, or to make changes in the work required as may be deemed necessary is reserved by the Owner as provided elsewhere in these Specifications and General Conditions.
- C. The basis of payment will be the actual unit Bid Items of work performed and measured in accordance with the Contract.

1.2 DESCRIPTION OF BID ITEMS

- A. The Bid items described herein are applicable to all contracts where the Bid item is listed in the Bid Form unless otherwise provided in the Contract Documents. Other items may be included in the Bid Form.
- B. Additional Items:
 - 1. Payment shall be made only for items listed in the Bid Form.
 - 2. All other items required for the work shall be considered incidental to the construction.
- C. Unless otherwise supplemented below, the unit price for a particular bid item shall constitute full compensation for all labor, materials, and equipment required to furnish, install, remove, dispose and/or replace such bid item, as specified and as shown on the Drawings or as directed by the Engineer.
- D. Bid unit prices shall be valid for any sequence of Work that is necessary or required to complete the Work. Contractor shall make no claim for additional compensation for performing any sequence of the Work that may cause unanticipated losses in production efficiency.

E. Bid Item descriptions and method of measurement for payment are as follows:

1. Mobilization:

- a. Mobilization shall include pre-construction costs of obtaining of all bonds, insurance, and permits; moving onto the site of all materials and equipment; temporary buildings and other construction facilities; for work and operations which Contractor shall perform or costs Contractor shall incur before beginning production of the work; all as required for the proper performance and completion of the work.
- b. Mobilization shall include but not be limited to the following principal items performed or established in accordance with the Contract Documents:
 - 1) Moving on to the site of all Contractor's supplies, materials and equipment.
 - 2) Installing the following on-site temporary construction utility systems:
 - a) potable water
 - b) waste disposal
 - c) power and lighting
 - d) communications
 - 3) Providing field office trailers for the Contractor, and the Engineer if specifically required, complete with all specified furnishings, utility services and equipment.
 - 4) Furnishing, installing and maintaining all yards, and buildings required for Contractor's storage and for temporary storage of products, equipment or materials that have not yet been installed in the work.
 - 5) Obtaining and paying for all permits required of the Contractor.
 - 6) Posting all OSHA-required notices and establishing safety programs.
 - 7) Contractor's superintendent is established at the project full-time.
 - 8) Submittal of required project schedules.
- c. Mobilization costs for all subcontracted work shall be considered to be included.
- d. Items which are not to be included in this item include but are not limited to:
 - 1) Any portion of the work covered by specific Bid Item or incidental work which is to be included in a Bid Item or Items.
 - 2) Profit, interest on borrowed money, overhead or management costs.
- e. The lump sum Contract price for "Mobilization", partial payments will be as follows:
 - 1) When 5% of the total original Contract amount is earned from other Bid Items, 50% of the amount Bid for mobilization, or 5% of the total original Contract amount, whichever is the least will be paid.

- 2) When 10% of the total original Contract amount is earned from other Bid Items, 100% of the amount Bid for mobilization, or 10% of the original Contract amount, whichever is the least, will be paid.
 - 3) Upon completion of all work on the project, payment of any amount Bid for mobilization in excess of 10% of the total original Contract amount will be paid.
2. Construction Survey
 - a. The lump sum bid price for Construction Survey shall constitute full compensation for all labor, materials, and equipment required for all survey and layout required to properly control the work including recovering and/or establishing vertical and horizontal control; determining right-of-way and easement boundaries; construction staking; re-staking if required; survey for record drawings; and delivery of survey data to Engineer.
 - b. Measurement for payment shall be percent complete as determined by the Engineer.
3. Erosion and Pollution Control
 - a. The lump sum bid price for Erosion and Pollution Control shall constitute full compensation for all labor, materials and equipment required to provide erosion and pollution control as described in the Contract Documents. The lump sum price for Erosion and Pollution Control shall include preparing for and obtaining all required permits; preparation, execution and maintenance of Storm Water Pollution prevention Plan (SWPPP); material and facilities necessary to meet the requirements of the Contract Documents and all required permits; re-establishment of any drainage pathways affected by construction activities; protection/restoration of existing drainage patterns; siltation prevention by fabric fencing or other approved means; cleanup; and other related work as shown or described in the Contract Documents.
 - b. Measurement for payment shall be percent complete as determined by the Engineer.
4. Water Treatment Plant Upgrades
 - a. The lump sum bid price for Water Treatment Plant Upgrades shall constitute full compensation for all labor, materials, and equipment required to furnish and install all improvements to the existing water treatment plant as described in the Contract Documents. The lump sum price for Water Treatment Plant Upgrades shall include all work performed within and adjacent to the water treatment plant including demolition as required; furnishing and installation of piping, pumps, valves, instrumentation, electrical controls and control panels, treatment equipment, filter upgrades, electrical equipment, boilers, mechanical components, temporary water connections, cleanup; and other related and ancillary work as shown or described in the Contract Documents and as required to provide complete and functional systems.
 - b. Measurement for payment shall be percent complete as determined by the Engineer.
5. Furnish and Install 6X15 Raw Water Service Line

- a. The unit price per linear foot for Furnish and Install 6X15 Raw Water Service Line shall constitute full compensation for all labor, equipment and materials to: furnish and install 6x15 raw water service line arctic pipe and fittings; furnish and install insulated joint kits; timber pipe supports; cleaning; hydrostatic testing; disinfection; protection/restoration of existing utilities; protection/restoration of existing drainage patterns; removal and replacement of existing culverts, fences, retaining walls, flag poles, landscaping, roadways and other public or private improvements as necessary for construction; cleanup; and miscellaneous items required to furnish and install 6x15 raw water service line as shown or described in the Contract Documents.
 - b. Measurement for payment shall be along the horizontal centerline of pipe.
6. Furnish and Install 6X18 Below-Grade Raw Water Main
 - a. The unit price per linear foot for Furnish and Install 6X18 Below-Grade Raw Water Main shall constitute full compensation for all labor, equipment and materials to: furnish and install 6x18 below-grade raw water main arctic pipe and fittings; furnish and install insulated joint kits; excavating; bedding and backfill, cleaning; testing; protection/restoration of existing utilities; protection/restoration of existing drainage patterns; protection /restoration of existing vegetation; removal and replacement of existing culverts, fences, landscaping, roadway and other public or private improvements as necessary for construction; cleanup; and miscellaneous items required to furnish and install 6x18 below-grade raw water main as shown or described in the Contract Documents.
 - b. Measurement for payment shall be along the horizontal centerline of pipe.
7. Furnish and Install 6X18 Above-Grade Raw Water Main
 - a. The unit price per linear foot for Furnish and Install 6X18 Above-Grade Raw Water Main shall constitute full compensation for all labor, equipment and materials to: furnish and install 6x18 above-grade raw water main arctic pipe and fittings; furnish and install insulated joint kits; pipe supports, cleaning; testing; protection/restoration of existing utilities; protection/restoration of existing drainage patterns; protection /restoration of existing vegetation; removal and replacement of existing fences, landscaping, and other public or private improvements as necessary for construction; cleanup; and miscellaneous items required to furnish and install 6x18 above-grade raw water main as shown or described in the Contract Documents.
 - b. Measurement for payment shall be along the horizontal centerline of pipe.
8. Resurface Public Roadway (Gravel)
 - a. The unit price per linear foot of Resurface Public Roadway shall constitute full compensation for all labor, equipment, and material required for: furnishing and placement of gravel subbase and surface course as required to match existing road conditions; mechanical compaction to specified density; protection/restoration of existing drainage patterns; removal and replacement of fences, retaining walls,

- landscaping, and other public or private improvements; cleanup; and miscellaneous items required to resurface public roadway as described in the Contract Documents.
- b. Measurement for payment shall be per liner foot of resurface public roadway (gravel) as shown on the Drawings.
9. Resurface Public Roadway (A.C. Pavement)
- a. The unit price per square yard of Resurface Public Roadway (A.C. Pavement) shall constitute full compensation for all labor, equipment, and material required for: furnishing and placement of gravel subbase, leveling course, and A.C. pavement as required to match existing road conditions; mechanical compaction to specified density; cleaning; protection/restoration of existing drainage patterns; removal and replacement of fences, landscaping, and other public or private improvements; cleanup; and miscellaneous items required to resurface public roadway as described in the Contract Documents.
 - b. Measurement for payment shall be per square yard of resurface public roadway (A.C. Pavement) as shown on the Drawings.
10. Furnish and Install Wellhead Enclosures
- a. The unit price per each for Furnish and Install Wellhead Enclosure shall constitute full compensation for all labor, equipment and materials to: furnish and install wellhead enclosures and foundation system; furnish and install wellhead piping, instrumentation and valves, furnish and install enclosure heating and electrical system; furnish and install instrumentation and controls; cleaning; hydrostatic testing; disinfection; protection/restoration of existing utilities; protection/restoration of existing drainage patterns; cleanup; and miscellaneous items required to furnish and install wellhead enclosures as shown or described in the Contract Documents.
 - b. Measurement for payment shall be per enclosure as shown on the Drawings.
11. Construct Access Road
- a. The unit price per linear foot for Construct Access Road shall constitute full compensation for all labor, equipment, and material required for: furnishing and placement of geotextile, road embankment and surface course; furnish and placement of embankment material for wellhead pads; mechanical compaction to specified density; protection/restoration of existing drainage patterns; cleanup; and miscellaneous items required to construct access roads as described in the Contract Documents.
 - b. Measurement for payment shall be per linear foot of access road constructed as shown on the Drawings.
12. Furnish and Install Culvert
- a. The unit price per each culvert furnished and installed shall constitute full compensation for all labor, materials, equipment required to: furnish and install culverts as identified in the drawings. All excavation, backfill, insulation, accessories as shown or described in the Contract Documents. Excavation, backfilling, compaction, dewatering and grading or ditching necessary to direct water into or out of the culvert, are incidental items.
 - b. Measurement for payment shall be each culvert installed.

13. Construct Wellfield Power Distribution System
 - a. The lump sum bid price for Construct Wellfield Power Distribution System shall constitute full compensation for all labor, equipment, and material required for: furnishing and constructing of power poles, power distribution lines, disconnects, manual transfer switch, meters, unistrut, raceways, service drops, tie-in to UVEC power distribution system, transformers, associated appurtenances; and miscellaneous items required to construct the power distribution system as described in the Contract Documents. This includes permitting costs and time to coordinate with UVEC power.
 - b. Measurement for payment shall be percent complete as determined by the Engineer.

1.3 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

- A. Payment will not be made for following:
 1. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
 2. Unauthorized quantities of wasted or disposed materials.
 3. Rejected material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
 4. Material not unloaded from transporting vehicle.
 5. Defective work not accepted by Owner.
 6. Material remaining on hand after completion of work.

1.4 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

- A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless shop drawings and/or submittals are accepted by the Engineer. Only equipment destined for incorporation into the project shall be eligible for partial payment. Materials payments shall only be considered for materials or equipment stored in protected environment at the job site in **Unalakleet, Alaska**. Payments will only be made for materials or equipment verified by Engineer to be in good condition after delivery. Contractor shall provide invoice for payment of stored materials and equipment prior to payment. In no case shall payment be made for a greater amount than that shown on the invoice as having been paid by the Contractor for said materials or equipment.
- B. Final Payment: Will be made only for products incorporated in work, Remaining products, for which partial payments have been previously made, shall revert to Contractor unless otherwise agreed, and such partial payments made for those items will be de-ducted from final payment.

1.5 ITEMS INCIDENTAL TO THE CONTRACT

- A. The following items are considered incidental to the overall contract or individual Pay Items and no separate measurement for payment shall be made:
1. Clearing and Grubbing
 2. Record Drawings
 3. Landscape Restoration
 4. Utility location and verification
 5. Shoring utility and power poles and protection of overhead and underground utilities.
 6. Removal and replacement of public and private improvements not identified as being measured for payment (pipe crossings, boardwalks, dog houses, stairways, etc.).
 7. Providing safe hauling routs for transporting excavation material, fill, other construction material, and site access.
 8. Resetting disturbed survey monumentation.
 9. Post-construction cleanup.
 10. Repair of public or private improvements damaged by Contractor's operations.
 11. Other items as described in the Contract Documents.

END OF SECTION

SECTION 01 31 19 PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION CONFERENCE

- A. Before start of construction, Engineer will arrange a meeting with Contractor. The meeting agenda will include the following:
 - 1. Minimum Agenda:
 - a. Correspondence procedures
 - b. Designation of responsible personnel
 - c. Labor standards provisions
 - d. Payroll reports
 - e. Changes
 - f. Payments to Contractor
 - g. Subcontractors
 - h. Accident prevention program (including name of responsible supervisor)
 - i. Accident reporting
 - j. Documents required under the contract
 - k. Saturday, Sunday, holiday and night work
 - l. Safety program (compliance with the "Accident Prevention" clause of the
 - m. General Provisions)
 - n. Tentative construction schedule
 - o. Submittal of shop drawings, project data, and samples
 - p. Relationship of Division 01 to other divisions
 - q. Local Hire Opportunities

1.2 PROGRESS MEETINGS

- A. The Engineer will schedule meetings every week, or less if agreed upon by Owner, Engineer, and Contractor, with the Contractor and subcontractors. The Engineer will be responsible for recording, and distribution, of the meeting minutes. The meeting agenda will include the following as a minimum:
 - 1. Approval of minutes of previous meetings
 - 2. Field observations, problems, and decisions
 - 3. Identification of problems which impede planned progress
 - 4. Review of submittals schedule and status of submittals
 - 5. Review of off-site fabrication and delivery schedules
 - 6. Status of project record drawings/specifications

7. Maintenance of progress schedule
8. Corrective measures to regain projected schedules
9. Planned progress during succeeding work period (Note: planned progress will be provided on a weekly basis)
10. Coordination of projected progress
11. Maintenance of quality and work standards
12. Effect of proposed changes on progress schedule and coordination
13. Other business relating to work
14. Review of the monthly progress payment

1.3 SUBMITTALS

- A. The Engineer will provide meeting minutes for review and approval to all meeting participants prior to the next meeting or within one week of meeting, whichever is sooner. If no comments are returned in writing to the Engineer then the meeting minutes will be assumed correct.

PART 2 - PRODUCTS (NOT USED).

PART 3 - EXECUTION (NOT USED).

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Submittals.
- B. Network analysis schedules
- C. Review and evaluation
- D. Updating schedules
- E. Distribution

1.2 SUBMITTALS

- A. Schedule Updates:
 - 1. Overall percent complete, projected and actual.
 - 2. Completion progress by listed activity and sub-activity, to within five working days prior to submittal.
 - 3. Changes in Work scope and activities modified since submittal.
 - 4. Delays in submittals or resubmittals, deliveries, or Work.
 - 5. Adjusted or modified sequences of Work.
 - 6. Other identifiable changes.
 - 7. Revised projections of progress and completion.
- B. Narrative Progress Report:
 - 1. Submit with each monthly submission of Progress Schedule.
 - 2. Summary of Work completed during the past period between reports.
 - 3. Work planned during the next period.
 - 4. Explanation of differences between summary of Work completed and Work planned in previously submitted report.
 - 5. Current and anticipated delaying factors and estimated impact on other activities and completion milestones.
 - 6. Corrective action taken or proposed.

1.3 NETWORK ANALYSIS SCHEDULES

- A. Prepare network analysis diagrams and supporting mathematical analyses using critical path method.
- B. Illustrate order and interdependence of activities and sequence of Work; how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.
- C. Illustrate complete sequence of construction by activity, identifying Work of separate stages. Indicate dates for submittals and return of submittals; dates for procurement and delivery of critical products; and dates for installation and provision for testing. Include legend for symbols and abbreviations used.
- D. Prepare sub-schedules for each stage of Work and Sequencing of Construction Plan identified in Section 01 10 00 - Summary.

1.4 REVIEW AND EVALUATION

- A. Participate in joint review and evaluation of schedules with Engineer at each submittal.
- B. Evaluate Project status to determine Work behind schedule and Work ahead of schedule.
- C. After review, revise schedules incorporating results of review, and resubmit within 10 days.

1.5 UPDATING SCHEDULES

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update schedules to depict current status of Work.
- C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- D. Upon approval of a Change Order, include the change in the next schedule submittal.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit documentation as required to support recommended changes.
- G. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken (or proposed) and its effect.

1.6 DISTRIBUTION

- A. Following joint review, distribute copies of updated schedules to Contractor's Project site file, to Subcontractors, suppliers, and Engineer.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01 33 00**SUBMITTALS PROCEDURES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The work of this section consists of submittal requirements before and during construction.

1.2 SCHEDULES

- A. As soon as possible after Notice of Award and before beginning any work, submit Progress Schedule and Schedule of Values as a package. Engineer will review the Progress Schedule and the Schedule of Values for format and content.
1. Progress Schedule: Submit an electronic copy of Progress Schedule showing estimated starting and completion dates for each part of the work. The first progress payment will not be issued until an acceptable progress schedule is submitted.
 2. Schedule of Values: Submit a schedule of dollar values including all major components and mile stones for each phase of construction. Break down into component parts each phase using a series of operations for which progress payments may be requested. The total cost of all items shall equal the contract sum. The Engineer may request data to verify accuracy of dollar values.

1.3 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES:

- A. General Procedures:
1. As specified in the individual sections, forward submittals to Engineer at least 30 days before need for approval. Unless a different number is specified, submit one electronic version of each shop drawing, one specimen of each sample, and one electronic version of all other submittals requested.
 2. Coordinate all submittals and review them for legibility, accuracy, completeness, and compliance with contract requirements. Forward submittals that are related to or affect one another as a package to facilitate coordinated review.
 3. Submittals will not be accepted for review if identification or approval stamps are missing or are placed on the back of the submittal, an incorrect amount of submittals are submitted, the transmittal form is incorrectly filled out, submittals are not coordinated, or submittals do not show evidence of Contractor's approval.
 4. Engineer reserves the right to require submittals in addition to those called for in individual sections.
- B. Specific Procedures:

1. Shop Drawings: Identify each copy of shop drawings with contract drawing number in lower right hand corner.
 2. Samples: Samples shall be large enough to illustrate clearly the functional characteristics and full range of color, texture, or pattern.
 3. Manufacturers' Literature: Submit only pertinent pages; mark each copy of standard printed data to identify products referenced in specification section.
- C. Engineer Approval:
1. Engineer will indicate approval or disapproval of each submittal and the reasons for disapproval.
 2. After Engineer review, revise and resubmit as required. Identify changes made since previous submittal.
 3. When Engineer has approved submittals, Contractor's copies will be returned. Any work done before approval shall be at Contractor's own risk. No payment shall be made for any work performed without an approved submittal.

1.4 APPROVED EQUALS:

- A. For each item proposed as an "approved equal," submit a separate request that is clearly marked as an "approved equal request" to the Engineer. With each request submit supporting data, including:
1. Drawings and samples as appropriate.
 2. Comparison of the qualities of the proposed item with that specified.
 3. Changes required in other elements of the work because of the substitution.
 4. Name, address, and telephone number of vendor.
 5. Manufacturer's literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.
- B. A request for approval constitutes a representation that Contractor:
1. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.
 2. Will provide the same warranties for the proposed item as for the item specified.
 3. Has determined that the proposed item is compatible with interfacing items.
 4. Will coordinate the installation of an approved item and make all changes required in other elements of the work because of the substitution.
 5. Waives all claims for additional expenses that may be incurred as a result of the substitution.
- C. The Engineer has final determination whether or not an item is approved and considered equal.

1.5 MANUFACTURER'S INSTALLATION INSTRUCTIONS

- A. When contract documents require compliance with manufacturer's printed instructions, provide one complete set of instructions for Engineer and keep another complete set of instructions at the project site until substantial completion.

PART 2 - PRODUCTS: (NOT USED).

PART 3 - EXECUTION: (NOT USED).

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality control.
- B. Tolerances.
- C. References.
- D. Labeling.
- E. Testing and inspection services.
- F. Manufacturers' field services.

1.2 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with specified standards as the minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- C. Perform Work using persons qualified to produce required and specified quality.
- D. Products, materials, and equipment may be subject to inspection by Engineer at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.
- E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current as of date of Contract Documents except where specific date is established by code.
- C. Obtain copies of standards and maintain on Site when required by product Specification Sections.
- D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- E. Neither contractual relationships, duties, or responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference in reference documents.

1.5 LABELING

- A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code or State statute.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.

1.6 TESTING AND INSPECTION SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing unless otherwise noted.
 - 1. Before starting Work, submit testing laboratory name, address, and telephone number, and name of responsible officer.
- B. Testing, inspections, and source quality control may occur on or off Project Site.

- C. Reports shall be submitted by independent firm to Engineer, Contractor, and authorities having jurisdiction, indicating observations and results of tests and compliance or noncompliance with Contract Documents.
 - 1. Submit final report indicating correction of Work previously reported as noncompliant.
- D. Employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work according to requirements of Contract Documents.
- E. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by same independent firm on instructions from Engineer. Payment for retesting or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
- F. Agency Responsibilities:
 - 1. Provide qualified personnel at Site. Cooperate with Engineer and Contractor in performance of services.
 - 2. Perform indicated sampling and testing of products according to specified standards.
 - 3. Ascertain compliance of materials with requirements of Contract Documents.
 - 4. Promptly notify Engineer and Contractor of observed irregularities or nonconformance of Work or products.
 - 5. Perform additional tests required by Engineer.
- G. Agency Reports: After each test, promptly submit two copies of report to Engineer, Contractor, and authorities having jurisdiction. When requested by Engineer, provide interpretation of test results. Include the following:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and Specification Section.
 - 6. Location in Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.
- H. Limits on Testing Authority:
 - 1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency or laboratory may not approve or accept any portion of the Work.
 - 3. Agency or laboratory may not assume duties of Contractor.
 - 4. Agency or laboratory has no authority to stop the Work.

1.7 MANUFACTURER'S FIELD SERVICES

- A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment commissioning as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Engineer 30 days in advance of required observations.
- C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

1.8 SUBMITTALS

- A. Prior to start of Work, the Contractor shall submit a written Quality Control Plan (QCP) for testing services for the project for approval by the Owner. The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. Construction field work will be permitted to begin only after acceptance of the QCP Plan. The plans shall contain at a minimum;
 - 1. A description of the quality control organization, including a chart showing lines of authority and identifying the individual that will be responsible for implementing the QCP, and cannot be the superintendent.
 - 2. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents subcontractors, consultants, offsite fabricators, and suppliers.
 - 3. Testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test.
 - 4. Procedures for scheduling, tracking inspections and testing, to include example forms and required documentation. This shall include a complete list of all inspections and tests required by the contract documents, and tracking procedures to ensure completion.
 - 5. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01 50 00**TEMPORARY FACILITIES AND CONTROLS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Temporary Utilities:
 - 1. Temporary electricity.
 - 2. Temporary lighting for construction purposes.
 - 3. Temporary heating.
 - 4. Temporary ventilation.
 - 5. Communication services.
 - 6. Temporary water service.
 - 7. Temporary sanitary facilities.
- B. Construction Facilities:
 - 1. Field offices and sheds.
 - 2. Traffic regulation.
 - 3. Parking.
 - 4. Progress cleaning and waste removal.
 - 5. Project identification.
 - 6. Fire-prevention facilities.
- C. Temporary Controls:
 - 1. Barriers.
 - 2. Enclosures and fencing.
 - 3. Security.
 - 4. Water control.
 - 5. Dust control.
 - 6. Noise control.
 - 7. Pollution control.
 - 8. Erosion and sediment control.
- D. Special Controls:
 - 1. Recovery and Preservation of Archaeological and Cultural Resources
- E. Removal of utilities, facilities, and controls.

1.2 REFERENCES

- A. Alaska Department of Environmental Conservation (ADEC):
 - 1. AKR100000 - General Permit for Discharges from Large and Small Construction Activities.
 - 2. Alaska Storm Water Guide – December 2011.

1.3 TEMPORARY ELECTRICITY

- A. Contractor shall provide temporary electricity to project Work Site at Contractors expense. Contractor shall pay for cost of energy at project Work Site.
- B. Contractor shall provide temporary electricity to field office and Engineer's field office at Contractors expense. Contractor shall pay for cost of energy at field offices.
- C. Owner will pay cost of energy used in the water treatment plant and washeteria. Exercise measures to conserve energy. Use Owner's existing power service.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain lighting for construction operations to achieve minimum lighting level of 2 watts/sq ft.
- B. Maintain lighting and provide routine repairs.
- C. Permanent building lighting may be used during construction.

1.5 TEMPORARY HEATING

- A. Existing heating systems, where available, may be used to heat the construction area during construction.
- B. Contractor shall provide and pay for temporary heating to field office and Engineer's field office throughout construction.
- C. When building heating system is offline during construction, Contractor shall provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.
- D. Before operating permanent equipment for temporary heating purposes, verify installation is approved for operation, equipment is lubricated, and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts. Replace filters at Substantial Completion.

- E. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress.

1.6 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.7 COMMUNICATION SERVICES

- A. Telephone Service: Provide, maintain, and pay for telephone service to field office at time of Project mobilization and until completion of Work.
- B. Internet Service: Provide, maintain, and pay for broadband Internet service to field office at time of Project mobilization. Provide desktop computer with Microsoft operating system and appropriate office function software (MS Word, MS Excel, MS Outlook, internet web browser, etc), modem, and printer.

1.8 TEMPORARY WATER SERVICE

- A. Owner will pay cost of temporary water. Exercise measures to conserve water. Use Owner's existing water system, extended and supplemented with temporary devices as needed to maintain specified conditions for construction operations. Contractor shall provide alternative water source when existing water system is taken offline for construction activities.
- B. Extend piping as necessary with outlets located so that water is available by hoses with threaded connections. Provide backflow prevention devices at each existing service.
- C. Temporary water lines shall be drained during project shutdown or when Contractor is offsite for extended period (more than 5 consecutive days).

1.9 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of Project mobilization.

1.10 FIELD OFFICES, TEMPORARY BUILDINGS AND SHEDS

- A. Field Office: Weathertight, with lighting, electrical outlets, heating equipment, and equipped with sturdy furniture.
- B. Provide space for Project meetings, with table and chairs to accommodate six persons.

- C. Construction: Portable or mobile buildings, or buildings constructed with floors raised aboveground, securely fixed to foundations with steps and landings at entrance doors.
 - 1. Construction: Structurally sound, secure, weathertight enclosures for office and storage spaces. Maintain during progress of Work; remove enclosures at completion of Work.
 - 2. Thermal Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
 - 3. Exterior Materials: Weather-resistant.
 - 4. Interior Materials in Field Offices: Sheet-type materials for walls and ceilings, prefinished or painted; resilient floors and bases.
 - 5. Lighting for Field Offices: 50 ft-C at desktop height; exterior lighting at entrance doors.
 - 6. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.
- D. Environmental Control:
 - 1. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain comfort conditions.
 - 2. Storage Spaces: Heating and ventilating as needed to maintain products according to Contract Documents; lighting for maintenance and inspection of products.
- E. Engineer Field Office – Not used.
- F. Preparation: Fill and grade Sites for temporary structures sloped for drainage away from buildings.
- G. Installation:
 - 1. Install field office spaces ready for occupancy 15 days before start of construction.
- H. Maintenance and Cleaning:
 - 1. Weekly janitorial services for field offices; periodic cleaning and maintenance for sheds and storage areas.
 - 2. Maintain walks free of mud, water, snow, and the like.
- I. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas to same or better condition as original condition.

1.11 TRAFFIC REGULATION

- A. General: Work shall be conducted to interfere as infrequent as possible with public travel.
- B. Construct temporary access roads as required from public thoroughfares to serve construction area, of width and load-bearing capacity to accommodate unimpeded traffic for construction purposes.

- C. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- D. Extend and relocate vehicular access as Work progress requires and provide detours as necessary for unimpeded traffic flow.
- E. Locate as approved by Engineer.
- F. Provide unimpeded access for emergency vehicles. Maintain 20 foot-wide driveways with turning space between and around combustible materials.
- G. Provide and maintain access to fire hydrants free of obstructions.
- H. Traffic detours and interruptions shall be publicly noticed ahead of time and marked with traffic cones and signage during construction and after hours.
- I. Signs, Signals, and Devices:
 - 1. Post-Mounted and Wall-Mounted Traffic Control and Informational Signs: As approved by authorities having jurisdiction.
 - 2. Traffic Control Signals: As approved by local jurisdictions.
 - 3. Traffic Cones, Drums, Flares, and Lights: As approved by authorities having jurisdiction.
 - 4. Flag Person Equipment: As required by authorities having jurisdiction.
- J. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- K. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- L. Traffic Signs and Signals:
 - 1. Provide signs at approaches to Site and on Site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
 - 2. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.
 - 3. Relocate signs and signals as Work progresses, to maintain effective traffic control.
- M. Removal:
 - 1. Remove equipment and devices when no longer required.
 - 2. Repair damage caused by installation.
 - 3. Remove post settings to depth of 2 feet.

1.12 PARKING

- A. Arrange for temporary gravel surface parking areas to accommodate construction personnel.

- B. Locate as approved by Engineer.
- C. If Site space is not adequate, provide additional off-Site parking.
- D. Use of designated areas of existing on-Site streets and driveways used for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.
- E. Use of designated areas of existing parking facilities adjacent to the water treatment plant by construction personnel is not permitted.
- F. Do not allow heavy vehicles or construction equipment in parking areas.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in clean and orderly condition.
- B. Remove debris and rubbish from closed or remote spaces before enclosing spaces.
- C. Broom and vacuum clean interior areas before starting surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from Site periodically and dispose of off-Site. Comply with Section 01 74 19 - Construction Waste Management and Disposal.

1.14 FIRE-PREVENTION FACILITIES

- A. Prohibit smoking within buildings at all times. Designate area on Site where smoking is permitted. Provide approved ashtrays in designated smoking areas.
- B. Establish fire watch for cutting, welding, and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.
- C. Portable Fire Extinguishers: NFPA 10; 10-pound capacity, 4A-60B: C UL rating.
 - 1. Provide one fire extinguisher within 10 feet of construction area.
 - 2. Provide minimum of one fire extinguisher in every construction trailer and storage shed.
 - 3. Provide minimum of one fire extinguisher on roof during roofing operations using heat-producing equipment.

1.15 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to allow for Owner's use of Site, and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Protect non-owned vehicles, stored materials, Site, and structures from damage.

1.16 ENCLOSURES AND FENCING

- A. Construction: Contractor's option.
- B. Exterior Enclosures:
 - 1. Provide temporary weathertight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual Specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- C. Interior Enclosures – not used.

1.17 SECURITY

- A. Security Program:
 - 1. Protect Work on existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
 - 2. Initiate program at Project mobilization.
 - 3. Maintain program throughout construction period until Owner's acceptance precludes need for Contractor's security.
 - 4. Owner will control entrance of persons and vehicles related to Owner's operations.

1.18 DUST CONTROL

- A. Execute Work by methods that minimize raising dust from construction operations. Use water or other dust control measures to alleviate fugitive dust during construction.
- B. Provide positive means to prevent airborne dust from dispersing into building atmosphere and into Owner-occupied areas.

1.19 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise produced by construction operations.
- B. Mufflers shall be maintained on all construction equipment.

1.20 PEST AND RODENT CONTROL

- A. Provide methods, means, and facilities to prevent pests and insects from entering facility during Contractor's operations.

1.21 WATER CONTROL

- A. Grade Site to drain. Maintain excavations free of water. Provide, operate, and maintain necessary pumping equipment.
- B. Protect Site from puddles or running water. Provide water barriers as required to protect Site and surrounding areas from soil erosion and contamination.'
- C. If dewatering is to occur at excavation sites, the Contractor shall obtain a discharge permit from the Alaska Department of Environmental Conservation (ADEC).

1.22 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills from borrow and waste disposal areas. Prevent erosion and sedimentation.
- B. Minimize surface area of bare soil exposed at one time.
- C. Provide temporary measures including fiber matrix covering, berms, dikes, drains, and other devices to prevent erosion and sedimentation.
- D. Construct fill and waste areas by selective placement to avoid erosive surface silts and clays.
- E. Periodically inspect earthwork to detect evidence of erosion and sedimentation. Promptly apply corrective measures.
- F. Best management practices shall be used for erosion control where ground disturbance occurs.
- G. Provide, implement and comply with Storm Water Pollution Prevention Plan (SWPPP) in accordance with State of Alaska Department of Environmental Conservation (ADEC) requirements and guidelines. Submit a Notice-of-Intent (NOI) prior to construction.

1.23 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.
- B. Comply with pollution and environmental control requirements of authorities having jurisdiction.
- C. Water Pollution Control:
 - 1. Provide necessary erosion control measures, silt fences, straw bales, and other means as required and as specified in the SWPPP to protect wetlands adjacent to excavations, temporary stockpiles, and fill sites from contamination by sedimentation and spilling.

2. Divert sanitary and non-storm waste flow interfering with construction and requiring diversion to sanitary sewer collection system or treatment facility.
 3. Do not cause or permit action to occur which would cause an overflow to an existing waterway.
 4. Prior to commencing excavation and construction, obtain Engineer's concurrence with detailed plans showing procedures intended to handle and dispose of wastewater, groundwater, and storm water flow, including dewatering pump discharges.
 5. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris and rubbish.
- D. Storage of Fuel and Petroleum Products: Storage of fuel and petroleum products shall not be permitted within 200 feet of a water body (i.e., rivers, streams, lakes, wells, wetlands, or marine waters which provide domestic or public water supplies, support anadromous fish populations, or are adjacent to areas of human settlement or use which are highly susceptible to petroleum contamination) or within the 100-year floodplain, whichever is greater, unless written justification is submitted to and accepted by the agency having jurisdiction. Justification shall clearly describe:
1. Why such placement is unavoidable, and;
 2. The precautions that will be taken to prevent uncontained leaks and/or spills.
 3. Fuel storage tanks shall be provided with at least one mechanical or operational means to minimize the potential for tank overfilling. Note: Mechanical float devices are not recommended, as they have a high failure rate in the Alaskan environment.
 4. Petroleum storage tanks shall be located within a secondary containment structure, or structures, that have the capacity to hold the volume of the largest tank within the containment area, plus enough additional capacity to allow for local precipitation.
 5. Secondary containment structure(s) shall be completely impermeable, with ground surfacing and berms, dikes, or retaining walls constructed of impermeable materials, or lined with impermeable materials. This requirement includes the ground under the tanks, in order to prevent the release of spilled or leaked petroleum from the containment area.
 6. Each containment structure shall be constructed so that it can be drained of accumulated water through a secure valve with a locking mechanism to prevent unauthorized discharge. Water discharged from the containment area, and runoff discharged from fuel dispensing facilities shall meet the State Water Quality Standards in 18 AAC 70. Any sheen present on the accumulated water shall be removed by using sorbent pads, an oil/water separator, or other effective means prior to discharge.
 7. To assist in leak detection, all piping, to the extent practicable, shall be above ground. Examples of possible exceptions are road crossings, containment dike penetrations, and piping in utilidors. Aboveground piping shall be placed on pipe supports that prevent chaffing and corrosion. Underground piping shall be adequately protected against corrosion.
- E. Pollution Control Plan:
1. Contractor shall perform containment, cleanup, and disposal of all construction-related discharges of oil and/or other hazardous substances to the land or water. Contractor shall

prepare and submit to the Engineer a Pollution Control Plan which shall, as a minimum, address the following relative to hazardous substances:

2. Measures the Contractor shall implement in the containment and cleanup of accidental oil or other hazardous substance spills.
 3. Detail the quantity and types of supplies that will be on site to facilitate cleanup activities.
 4. Discuss the methods the Contractor shall implement in the disposal of waste oil or other hazardous substances generated by construction equipment or activities.
 5. The plan shall comply with the requirements of Alaska Administrative Code, Section 18 AAC 75, and Alaska Statute, Title 46.
- F. Notifications of Unauthorized Discharges of Oil or Fuel: The Contractor shall immediately notify ADEC by telephone, and immediately afterwards send ADEC a written notice by facsimile, hand delivery, or first class mail, informing ADEC of:
1. Any unauthorized discharges of oil or fuel to water, any discharge of hazardous substances other than oil or fuel, and any discharge or cumulative discharge of oil or fuel greater than 55 gallons solely to land and outside an impermeable containment area.
 - a. If a discharge, including cumulative discharge, of oil is greater than 10 gallons but less than 55 gallons, or a discharge of oil greater than 55 gallons is made to an impermeable secondary containment area, the Contractor shall report the discharge within 48 hours, and immediately afterwards send ADEC a written notice by facsimile, hand delivery, or first class mail.
 - b. Any discharge of oil, including a cumulative discharge, solely to land, greater than one gallon and up to 10 gallons, shall be reported in writing on a monthly basis.
 2. The posting of information requirements of 18 AAC 75.305 shall be met.
 3. Scope and duration of initial response Actions (18 AAC 75.310) and reporting requirements of 18 AAC 75, Article 3 also apply. The Contractor shall supply ADEC with all follow-up incident reports.
 4. Notification of a discharge shall be made to the nearest ADEC Area Response Team during working hours: Anchorage (907) 269-7500, fax (907) 269-7648. The ADEC oil spill report number outside normal business hours is (800) 478-9300.

1.24 SPECIAL CONTROLS

A. Tundra Protection Control:

1. Contractor shall submit Tundra Protection Control Plan to protect and prevent damage to tundra during construction.

B. Recovery and Preservation of Archaeological and Cultural Resources:

1. The Alaska Historic Preservation Act (AS 41.35.200) prohibits the appropriation, excavation, removal, injury, or destruction of any State-owned historic, prehistoric (paleontological) or archaeological site without a permit from the commissioner.
2. Contractor is advised that construction work within this contract is subject to the provisions of State and Federal laws and regulations pertaining to the preservation of archaeological and cultural resources.

3. In the event that any historic, cultural or archaeological resources are uncovered during the course of construction, all work shall cease until an inspection and evaluation of the site has been made by proper authorities and an archaeologist to insure that archaeological data are properly preserved. Contractor shall promptly notify Engineer who will in turn notify the proper authorities.
 4. All human remains, regardless of age, condition, or extent encountered, shall be regarded as potential archaeological resources, but State notification and response protocols shall be followed before an archaeological investigation is performed.
 5. Contractor shall anticipate reasonable delays while the notification and response protocols are being followed and archaeological investigations are being performed, and shall make allowance for these delays.
- C. Protected Birds: Follow USFWS Construction Advisory for Protecting Migratory Birds, and if an eagle's nest is observed within 660 feet of the project area during construction, notify Engineer and USFWS.
- D. Owner-provided Permits and Agreements: Copies of applicable permits or agreements obtained by the Owner are included in this project manual and are made part of the Contract requirements. Contractor activities shall comply with the following permit requirements:
1. Alaska General Permit for Storm Water Discharges from Large and Small Construction Activities (AKR100000). Work requires a contractor to provide Storm Water Pollution Prevention Plan (SWPPP).
 2. The Water Treatment Plant Wells are identified by the State as Public Water Systems and Drinking Water Protection Areas. Contractor shall manage construction activities within the DWPAs in conformance with State of Alaska recommendations.
- E. Dewatering Plan and SWPPP shall be submitted to and accepted by Engineer prior to commencement of any work at designated excavation areas.
1. Dewatering Plan shall be provided in accordance with Section 31 23 19 - Dewatering.

1.25 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials before Final Application for Payment inspection.
- B. Clean and repair damage caused by installation or use of temporary Work.
- C. Restore existing facilities used during construction to original condition except as identified on the Drawings. Restore permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS - Not Used**PART 3 - EXECUTION****3.1 SWPPP PRE-CONSTRUCTION ACTIVITIES**

- A. Contractor shall complete a description of the nature of the construction activities and the intended sequence of the construction activities which disturb soils for major portions of the site. The description of a construction activity should include the following information:
 - 1. Type of activity.
 - 2. Estimated dates of the activity (both start and finish dates).
 - 3. Name of Contractor or Subcontractor who is to accomplish the activity.
- B. Description of the Construction activities and any amendments to the SWPPP shall be written and attached to the Plan.
- C. No later than seven days prior to beginning construction activities, Contractor shall submit a NOI directly to the EPA and ADEC and deliver a copy to the Engineer at the time of submission.

3.2 SWPPP CONSTRUCTION ACTIVITIES

- A. The Contractor shall provide a list of Contractors and Subcontractors participating in each construction activity. The list is required to be kept current throughout the duration of the project. Each Contractor or Subcontractor shall be required to sign the Signature Page of this SWPPP document prior to the commencement of professional services.
- B. Contractor shall list the current activities and the names of Contractors or Subcontractors who complete each construction activity.

3.3 SWPPP MAINTENANCE AND INSPECTION

- A. The controls identified in the SWPPP for the project site shall be inspected periodically and maintenance shall begin as soon as a deficiency is observed.
- B. The Contractor shall provide a qualified person to inspect the disturbed areas of the construction site that have not been stabilized, the areas used for storage of materials that are exposed to precipitation, the structural control measures, and the location where vehicles enter or exit the site.
- C. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Control measures as identified in the Contractor's Plan shall be observed to ensure that they are effective in preventing impacts to receiving waters.
- D. An inspection report shall be written summarizing the scope of the inspection, the name(s) and qualification of personnel making the inspection, the date of inspection, major observations relating to the implementation of the SWPPP, and the actions and modifications taken to correct insufficiencies identified during the inspection. The report shall identify any incident of non-compliance. If no incidents of non-compliance are observed during the inspection, the report shall contain a certification that the facility is in compliance with the SWPPP and the ADEC General Permit. The inspection report shall be signed by the project superintendent or a duly

authorized representative. Any person signing a document for the SWPPP shall add the following certification:

1. "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system design to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine and imprisonment for knowing violations."
- E. All inspection reports shall be made and retained as part of the SWPPP. Each inspection report shall be appended by the Contractor to the original SWPPP.

END OF SECTION

SECTION 01 60 00**PRODUCT REQUIREMENTS****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.

1.2 PRODUCTS

- A. At minimum, comply with specified requirements and reference standards.
- B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.
- C. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.
- D. Do not use materials and equipment removed from existing premises except as specifically permitted by Contract Documents.
- E. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Comply with delivery requirements in Section 01 74 19 - Construction Waste Management and Disposal.
- B. Transport and handle products according to manufacturer's instructions.
- C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products according to manufacturer's instructions.

- B. Store products with seals and labels intact and legible.
- C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.
- D. For exterior storage of fabricated products, place products on sloped supports aboveground.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- I. Secure stored materials from damage due to flooding and floating debris from flood events.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and complying with Specifications; no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named, according to Section 01 33 00 - Submittal Procedures.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 70 00**EXECUTION AND CLOSEOUT REQUIREMENTS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Field engineering.
- B. Closeout procedures.
- C. Starting of systems.
- D. Demonstration and instructions.
- E. Project record documents.
- F. Operation and maintenance data.
- G. Operations and Maintenance Manual contents. .
- H. Spare parts and maintenance products.
- I. Product warranties and product bonds.
- J. Maintenance service.
- K. Examination.
- L. Preparation.
- M. Execution.
- N. Cutting and patching.
- O. Protecting installed construction.
- P. Final cleaning.

1.2 FIELD ENGINEERING

- A. Prior to beginning Work, establish floor, piping and conduit elevations within existing facility to ensure that new Work will meet proposed elevations in smooth and level alignment and without conflicting with materials designated to remain except where specifically detailed or indicated otherwise.

1.3 CLOSEOUT PROCEDURES

- A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:
 - 1. Submit maintenance manuals, Project record documents, digital images of construction photographs, and other similar final record data in compliance with this Section.
 - 2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
 - 3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
 - 4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities.
 - 5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
 - 6. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
 - 7. Perform final cleaning according to this Section.
- B. Substantial Completion Inspection:
 - 1. When Contractor considers Work to be substantially complete, submit to Engineer:
 - a. Written certificate that Work, or designated portion, is substantially complete.
 - b. List of items to be completed or corrected (initial punch list).
 - 2. Within seven days after receipt of request for Substantial Completion, Engineer will make inspection to determine whether Work or designated portion is substantially complete.
 - 3. Should Engineer determine that Work is not substantially complete:
 - a. Engineer will promptly notify Contractor in writing, stating reasons for its opinion.
 - b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Engineer.
 - c. Engineer will reinspect Work.
 - d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.

- e. 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, shall 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 to the Contractor.
- 4. When Engineer finds that Work is substantially complete, Engineer will:
 - a. Prepare Certificate of Substantial Completion on EJCDC C-625 - Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified and amended by Engineer and Owner (final punch list).
 - b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.
- 5. After Work is substantially complete, Contractor shall:
 - a. Allow Owner full occupancy of Project under provisions stated in Certificate of Substantial Completion.
 - b. Complete Work listed for completion or correction within time period stipulated.
- 6. Owner will occupy all of the building as specified in Section 01 10 00 - Summary.
- C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.
 - 1. When Contractor considers Work to be complete, submit written certification that:
 - a. Contract Documents have been reviewed.
 - b. Work has been examined for compliance with Contract Documents.
 - c. Work has been completed according to Contract Documents.
 - d. Work is completed and ready for final inspection.
 - 2. Submittals: Submit following:
 - a. Final punch list indicating all items have been completed or corrected.
 - b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
 - d. Accounting statement for final changes to Contract Sum.
 - e. Contractor's affidavit of payment of debts and claims.
 - f. Contractor affidavit of release of liens.
 - g. Consent of surety to final payment.
 - 3. Perform final cleaning for Contractor-soiled areas according to this Section.
- D. Final Completion Inspection:

1. Within seven days after receipt of request for final inspection, Engineer will make inspection to determine whether Work or designated portion is complete.
2. Should Engineer consider Work to be incomplete or defective:
 - a. Engineer will promptly notify Contractor in writing, listing incomplete or defective Work.
 - b. Contractor shall remedy stated deficiencies and send second written request to Engineer that Work is complete.
 - c. Engineer will re-inspect Work.
 - d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.
 - e. If some or all of the Work has been determined not to be at a point of Final 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, shall 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 to the Contractor.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for startup of various equipment and systems.
- B. Notify Engineer seven days prior to startup of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.
- G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.
- H. Submit a written statement to Engineer for each equipment and system that they have been properly installed and are functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel one week prior to date of Substantial Completion.

- B. For equipment or systems requiring seasonal operation, perform demonstration for other season two weeks prior to system operation switchover.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- F. Required instruction time for each item of equipment and system is specified in individual Specification Sections.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain on Site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, product data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates used.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
 - 1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
 - 2. Include locations of concealed elements of the Work.
 - 3. Identify and locate existing buried or concealed items encountered during Project.

4. Measured depths of foundations in relation to finish main floor datum.
 5. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 6. Field changes of dimension and detail.
 7. Details not on original Drawings.
- G. Submit marked-up paper copy documents to Engineer with claim for final Application for Payment.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit in PDF composite electronic indexed file.
- B. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.
- C. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- F. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
 2. Part 2: Operation and maintenance instructions arranged by system and parts category. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - g. Safety precautions to be taken when operating and maintaining or working near equipment.
 3. Part 3: Project documents and certificates, including the following:

- a. Shop Drawings and product data.
- b. Certificates.
- c. Originals of warranties.

1.8 OPERATIONS AND MAINTENANCE MANUAL CONTENTS

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
- B. For equipment or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes before Substantial Completion. Draft copy will be reviewed and returned after Substantial Completion, with Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit two sets of revised final volumes within ten days after final inspection.
- E. Submit in PDF composite electronic indexed file of final manual within ten days after final inspection.
- F. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations.
- G. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- H. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- I. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- J. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- K. Include color-coded wiring diagrams as installed.
- L. Operating Procedures: Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

- M. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- N. Include servicing and lubrication schedule and list of lubricants required.
- O. Include manufacturer's printed operation and maintenance instructions.
- P. Include sequence of operation by controls manufacturer.
- Q. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- R. Include control diagrams by controls manufacturer as installed.
- S. Include Contractor's coordination drawings with color-coded piping diagrams as installed.
- T. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- U. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- V. Include reports for testing and balancing as specified in Section 01 40 00 - Quality Requirements, Section 1.6 Testing and Inspection Services.
- W. Additional Requirements: As specified in individual product Specification Sections.
- X. Include listing in table of contents for design data with tabbed dividers and space for insertion of data.

1.9 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.
- B. Deliver to Project Site and place in location as directed by Owner; obtain receipt prior to final payment.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

- B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include table of contents and assemble in three D side ring binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
 - 2. Make other submittals within ten days after date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual Specification Sections.
- D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.
- B. Seal cracks or openings of substrate prior to applying next material or substance.

- C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 EXECUTION

- A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.
- B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
 - 1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
 - 2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
 - 3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Engineer for final decision.
- E. Allow for expansion of materials and building movement.
- F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
 - 1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.
 - 2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.
- G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
 - 1. Refer questionable mounting heights choices to Engineer for final decision.
 - 2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.
- H. Adjust operating products and equipment to ensure smooth and unhindered operation.
- I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

- A. Employ skilled and experienced installers to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Work of Owner or separate contractor.
- C. Execute cutting, fitting, and patching to complete Work and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and nonconforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.
- E. Restore Work with new products according to requirements of Contract Documents.
- F. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
- G. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- H. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated material to full thickness of penetrated element.
- I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- J. Identify hazardous substances or conditions exposed during the Work to Engineer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

3.6 FINAL CLEANING

- A. Execute final cleaning prior to final Project assessment.
 - 1. Employ experienced personnel or professional cleaning firm.
- B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces.
- C. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.
- D. Replace filters of operating equipment.
- E. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION

SECTION 01 71 23
CONSTRUCTION SURVEYING

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. General Conditions
- C. Section 013216 – Construction Progress Schedule
- D. Section 017000 – Execution and Closeout Requirements
- E. Section 311000 – Site Clearing
- F. Section 312316 – Excavation
- G. Section 312323 – Fill

1.2 SCOPE OF WORK

- A. Contractor shall furnish all labor and materials necessary to perform all surveying and staking essential for the completion of construction in conformance with the Contract Documents.
- B. Contractor shall perform all necessary work and calculations required to accomplish the work in accordance with these specifications and other portions of the Contract Documents.
- C. Contractor shall provide cross-sectional surveys of borrow site areas as required in Section 31 23 16, Excavation.
- D. Quality:
 - 1. This Section is intended to establish a standard minimum level of acceptable field survey specifications and procedures to properly control construction projects.
 - 2. It is the Contractor's responsibility to ensure proper survey methods and procedures are followed.
 - 3. Any errors resulting from the survey shall be corrected at the expense of the Contractor at no additional expense to the Village Safe Water Program.
 - 4. Any method conflicting with these survey specifications shall be approved by the Engineer prior to its use.

- E. All survey work shall be performed under the direct supervision of an Alaskan Registered Professional Land Surveyor.

1.3 PROJECT CONTROL

A. Control Data:

1. Village Safe Water Program will provide reference horizontal and vertical control data to facilitate construction staking.
2. Contractor shall establish and check all survey control prior to any staking activity to ensure the Project is properly located and constructed according to the Contract Documents.
3. If discrepancies are found, the Engineer shall be notified immediately.

B. Protection and Replacement:

1. Contractor shall preserve and protect all line stakes, grade stakes, reference points, and hubs.
2. In the event of their loss or destruction, Contractor shall pay all costs for their replacement.
3. Contractor shall replace any monument that exists within the construction limits, if it is disturbed or removed due to construction project activity.
4. All monumentation disturbed or removed shall be replaced with the same type monument or a monument approved by the Engineer.

C. Horizontal Control Accuracy:

1. The maximum permissible linear error allowed in establishing horizontal control is 1:5000 feet.
2. The maximum error allowed in unadjusted angular closure shall be calculated by the formula:

$$\text{error} = 30 \times \sqrt{N}$$

where the term "N" signifies the number of transit set-ups in the traverse and "30" signifies thirty seconds.

D. Vertical Control:

1. Elevations shall originate from the datum provided in the Drawings.
2. All level circuits run to establish temporary bench marks (TBMs) shall have an accuracy no less than the value computed by the formula:

$$\text{accuracy} = 0.03 \times \sqrt{d}$$

where the term "d" signifies the distance in miles.

3. Foresights and backsights shall be balanced.
4. The maximum sighting distance shall not exceed 300 feet.
5. All leveling circuits establishing TBMs shall be adjusted using recognized standard surveying adjustment methods.
6. Side shots to establish an elevation on TBMs will not be allowed.
7. A minimum of two known bench marks shall be used when establishing TBMs to verify correct elevation information.

8. A sufficient number of TBMs shall be set to control a project with a maximum spacing of 800 feet between marks.
9. A TBM shall not be greater than 200 feet outside the construction limits of the project.
10. All TBMs shall be located and shall be comprised of sufficient materials such that their integrity will not be compromised throughout the life of the Project.

E. Construction Centerline:

1. The construction centerline, which may or may not be an existing survey line, shall conform to that shown on the Drawings.
2. Any errors found in line shall be corrected and shown on the Record Drawings with reference to the plan centerline.
3. The permissible error of closure for horizontal distances measured along the construction centerline shall be 1:5000 feet.
4. At the time the construction centerline is established, or immediately thereafter, control points shall be referenced such that the line can be readily re-established when required.
5. Each reference point shall be visible to at least one other reference point.
6. Reference points shall be placed at locations where there is the least possibility of their being disturbed during the construction period and from which the centerline can be reset with a minimum of delay.
7. Measurements and sketches of the reference points shall be kept in the alignment/horizontal control book.
8. A minimum of two reference points shall be set to reference a project control point or monument.
9. A centerline profile shall be run prior to establishing construction grade stakes.
10. The existing ground elevations shall be checked against the existing profile elevations shown on the Drawings to verify design grade relations to the existing ground conditions.
11. Contractor shall review the centerline profile information to determine if a discrepancy large enough to adversely impact the Project design exists.
12. Contractor shall immediately notify the Engineer in writing if the data provided do not match conditions encountered in the field.

1.4 FIELD NOTES

A. Field Books:

1. Contractor shall supply uniform hard-backed "write-in-rain" or equivalent survey field books.
2. Village Safe Water Program has the right to inspect and take possession of the field books at any time throughout the course of the Project.
3. All field books shall be identified on the outside spine.
4. Each book shall be indexed and its contents referred to by page number prior to returning them to the Village Safe Water Program.
5. The date, weather conditions, survey crew personnel, and instruments used shall be shown at the beginning of each day's notes.
6. As a general rule, field notes for each phase of the Work shall be placed in a separate series of field books.

7. All field books used in the process of the Work are the property of the ANTHC and shall be submitted to the ANTHC upon completion of the Work or the end of the construction season.
8. All field books containing field note information shall be sealed and signed by a Registered Professional Land Surveyor on the title page of each field books.

B. Notes:

1. All observations shall be recorded directly into project field books; "pegging" of notes will not be acceptable.
2. All field notes shall be in pencil and recorded in standard bound field books as described above.
3. All field notes and drawings shall be completed and reduced before acceptance by the ANTHC.
4. Control sketches and traverse data shall be graphic and show measured and recorded distances.
5. The source of record shall be stated.
6. Stationing shall increase from the bottom of the page to the top of the page.
7. Notes shall be neat, legible, precise and sufficiently detailed.
8. If necessary, all survey work will be stopped until the notes are brought into conformance with the above requirements.
9. A copy of each day's field book notes shall be reduced and delivered to the office of the Engineer by 12:00 noon the next working day following any request by Engineer for such information.
10. The Engineer may issue a Stop Work Order at the Contractor's sole expense until the field notes are delivered within this time frame.

C. Corrections:

1. Erasures of errors in field books will not be accepted.
2. A line shall be drawn through those portions of the notes in error, leaving the original note legible, and the correction shall be noted above the original entry.
3. Corrections shall be initialed and dated.
4. Where appropriate, a note of explanation shall be included.

D. Engineer's Approval:

1. Failure on the part of the Contractor to keep and maintain complete and accurate field notes as required by this Section, shall be sufficient reason to withhold payment for those items of Work where survey is required.
2. No final project payment will be made to the Contractor until the field books have been submitted to and approved by the Engineer.

1.5 PARTY CHIEF'S DAILY DIARY

- A. The survey party chief shall keep a factual daily diary of all work performed by the survey crew on the project.
- B. The diary shall contain the following information, as a minimum:

1. Date
2. Crew
3. Type and location of work performed
4. Work accomplished
5. Orders from the Engineer
6. Signature

- C. This diary shall be kept on the Project Site and submitted to the Engineer upon request.
- D. At completion of the Project, this diary shall become the property of the ANTHC.

1.6 CLEARING AND GRUBBING STAKES

- A. Limits:
1. Contractor shall determine and stake the clearing limits as required to accomplish all Work described in the Contract Documents and/or as directed by the Engineer.
 2. Stakes shall be adjusted to avoid sharp breaks in the width of the clearing line.
 3. The staking of clearing limits shall be approved by the Engineer prior to the start of the clearing operations.
- B. Accuracy:
1. Distances shall be measured to the nearest foot and standard lath/flagging shall be placed to clearly designate the intended limits.
 2. Intervals for placement of lath/flagging shall vary based on the terrain and foliage density, although spacing of 50 to 100 feet will generally be adequate.

1.7 CROSS SECTIONS

- A. The Contractor shall perform all cross-section surveys necessary to verify that required lines and elevations of excavation are achieved and for establishing baseline surfaces for the determination of excavation quantities, including intermediate and/or re-measure cross sections. Measurement for excavated materials shall not include cleared and grubbed volumes.
- B. Cross sections shall be performed by the Contractor at the frequencies set forth in Section 31 23 16, Excavation.
- C. Cross-sectional volumes shall be progressively delineated on the topographical mapping set forth in Section 31 23 16, Excavation, and submitted with the progress measurements required therein.
- D. Locations:
1. Original ground cross sections shall be taken at the centerline of construction according to the Drawings and on each side of centerline at grade breaks, toes of slopes, centerlines of ditches, tops of banks, and at all other physical features within the project limits.
 2. Cross section stations shall be taken at 25-foot intervals and shall include intermediate stations wherever grade breaks occur.

3. Additional cross sections shall be taken at odd stations where structure exceptions begin or end.
 4. In areas where “overbreak” or slides are anticipated, cross sections shall be extended further to include the anticipated disturbed ground area.
- E. A digital file with point, northing, easting, elevation, description for each position of the cross section survey is required. A copy of all field notes is required. Field notes shall contain, but not limited to, the following:
1. Date of survey
 2. Type of instrument used to collect cross section positions
 3. Electronic file name(s)
 4. Instrument, backsight or antenna heights
 5. Identification of the backsight for each instrument setup (when applicable)
 6. Identification of GPS base station (when applicable)
 7. Documentation of a horizontal and vertical check shots in to known points at the beginning and end of each setup. Check shots shall be taken periodically throughout the survey to check instrument or GPS base station stability.
 8. Target/Rod heights at the beginning of the survey and when the heights are changed due to raising or lowering of the target or RTK GPS rover antenna.
- F. Instrumentation:
1. Cross-section surveys may be accomplished with total station with electronic data collection, or real time kinematic (RTK) GPS with a project dedicated GPS base station.
 2. RTK GPS shall not be employed without prior approval from the Engineer.
 3. The survey shall comply with or exceed the accuracies established herein.
 4. Conditions under which these methods may be used shall be discussed at the initial Preconstruction Conference with the Engineer.
 5. All cross sections shall be taken perpendicular to the centerline along tangents and on radial lines along curves.
 6. Surveyors shall make use of a right angle prism to or a “reference line” program within the GPS or total station to determine perpendiculars.
 7. Instrument and/or antenna heights shall be recorded to the nearest 0.01 foot.
 8. All elevations established on control used as part of the cross section survey shall be part of a closed level loop or by methods approved by the engineer prior to construction.
 9. If only one TBM is used when establishing vertical control, the level set-up shall be broken and a different instrument height obtained before closing into the same TBM.
 10. Accuracies:
 - a. The maximum allowable error for level loops used for vertical control for cross-section surveys shall not exceed 0.05 foot.
 - b. Cross section point accuracy shall not exceed +/-0.1 foot.
 - c. All surveys (total station or RTK GPS) shall start and end with a check measurement on at least 2 (backsight can count as one of the checks) or more established control points.

1.9 MISCELLANEOUS CONSTRUCTION STAKING

- A. Contractor shall provide sufficient stakes for the adequate control of all structures and incidental construction not specifically covered above.
- B. A staking diagram with respect to centerline and measurements for any pay quantities shall be maintained in the field notes.
- C. Other items such as horizontal and vertical control shall be shown in the field book and shall be governed by procedures established in previous articles of this Specification.

1.10 ELECTRONIC DATA COLLECTION AND RADIAL SURVEYS

- A. When electronic data collection is used or radial methods are used, the following criteria shall be maintained and submitted:
 - 1. A Standard Field Book Containing: Date of survey, weather conditions, instrumentation used, crew, Project description and sketch, listing of turning points and control points used, and other information needed to set up the reconstruction of the survey activity.
 - 2. A printout of the unedited output from the data collector or a copy of the radial field book entries to include: code descriptors, horizontal circle information, vertical circle information based on Zenith, slope distance expressed in feet, and a sheet containing the explanation of the codes used to identify the various shots.
 - 3. A printout of the reduced and adjusted (ratios of error and magnitude of misclosures shown) data, represented by X, Y and Z coordinates, plus necessary descriptive information.
 - 4. A plot and/or line drawing showing the control points, point occupied, and the radial observations at a scale large enough to read the point number, elevation, point description, and coordinates.
 - 5. When cross-sectional data are collected by radial methods, a printout/plot of the following data shall be provided:
 - a. Each point identified as it relates to the centerline station
 - b. The distance offset from centerline of the roadway or the construction centerline, whichever is applicable
 - c. The elevation and description of the shot
 - d. A cross-section line plot of each station with the individual shots averaged out to produce the final interpolated cross section
 - e. The vertical angle and distance to the TBMs used for control and the instrument height, and the height of the prisms

1.11 AS-BUILT SURVEYS, FIELD NOTES AND PROJECT RECORD DOCUMENTS

- A. As-Built Surveys:
 - 1. A Standard Field Book Containing: Date of survey, weather conditions, instrumentation used, crew, Project description and sketch, listing of turning points and control points used, and other information needed to set up the reconstruction of the survey activity.
 - 2. The as-builts shall also include, and kept current on a daily basis, swing ties to all existing structures including manholes, culverts, utility poles and pipelines.
- B. Survey measurements shall be taken, field notes shall be kept, and accuracies shall be attained in accordance with the specifications of this Section.
- C. Pay Request Information:
 - 1. A copy of all survey field notes, including line and grade books, shall be submitted with each pay request.
 - 2. Engineer has sufficient recourse to delay the processing of pay requests until the survey notes are received by the Engineer, and the Engineer is provided evidence that the Project Record Documents are current and in the required condition.
- D. Project Record Documents:
 - 1. Project Record Documents shall be redlined and kept current, and shall be kept ready for review for when Engineer, at his option, requests that the Project Record Documents be submitted with the survey field notes for the pay request.
 - 2. Project Record Documents shall be submitted along with a copy of the field notes to the Engineer at the completion of construction activity.
 - 3. These drawings shall be clearly stamped "Record Drawings."
 - 4. No final payment will be made to the Contractor until the Project Record Drawings and field notes have been submitted to and approved by the Engineer.

END OF SECTION

SECTION 01 74 19**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Construction waste management plan.

B. Related Sections:

1. Section 01 91 00 - Commissioning: General commissioning requirements.

1.2 PLAN REQUIREMENTS**A. Develop and implement construction waste management plan as approved by Engineer.****B. Intent:**

1. Reduce amount of construction and demolition debris from requiring landfill disposal.
2. Ensure that construction and demolition debris is properly disposed of in a landfill permitted by the State of Alaska.

1.3 SUBMITTALS**A. Section 01 33 00 - Submittal Procedures contains requirements for submittals.****B. Construction Waste Management Plan: Submit construction waste management plan describing methods and procedures for implementation and monitoring compliance including the following:**

1. Disposition of waste and hazardous waste.
2. On-Site sorting and Site storage methods.
3. Location of State permitted landfill for disposal of waste materials.

C. Submit documentation prior to Substantial Completion substantiating construction waste management plan was maintained and goals were achieved.

1. Trash: Quantity by volume deposited in landfills.
2. Salvaged Material: Quantity by volume with destination for each type of material salvaged for resale, recycling, reuse, or delivery to Owner.

1.4 CONSTRUCTION WASTE MANAGEMENT PLAN

- A. Implement construction waste management plan at start of construction.
- B. Review construction waste management plan at preconstruction meeting and progress meetings specified in Section 01 31 19 – Project Meetings.
- C. Distribute approved construction waste management plan to Subcontractors and others affected by plan requirements.
- D. Oversee plan implementation, instruct construction personnel for plan compliance, and document plan results.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE COLLECTION

- A. Collect construction waste materials in marked bins or containers and arrange for transportation to permitted landfill.
- B. Maintain storage and collection area in orderly arrangement with materials separated to eliminate co-mingling of materials designated for salvage.
- C. Store construction waste materials to prevent environmental pollution, fire hazards, hazards to persons and property, and contamination of stored materials.
- D. Cover construction waste materials subject to disintegration, evaporation, settling, or runoff to prevent polluting air, water, and soil.

3.2 CONSTRUCTION WASTE DISPOSAL

- A. All construction and demolition waste shall be delivered to a landfill permitted by the Alaska Department of Environmental Conservation. Disposal of waste in an unpermitted landfill is illegal.
- B. Construction and demolition waste shall only be disposed of in a landfill after permission from the landfill owner has been secured and all applicable fees have been paid.
- C. If an acceptable landfill cannot be secured within the City of Unalakleet, construction and demolition waste shall be transported to an acceptable landfill in another community for final disposal.

END OF SECTION

SECTION 01 91 00 COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commissioning description.
2. Submittals.
3. Qualifications
4. Commissioning services.
5. Commissioning responsibilities.
6. Commissioning meetings.
7. Commissioning reports.
8. Sequencing.
9. Scheduling.
10. Maintenance materials.
11. Test equipment.
12. Verification check and startup procedures.
13. Functional performance test procedures.
14. Function performance test methods.
15. Deficiencies and test approvals.
16. Demonstration.

B. HVAC Commissioning: Commissioning of HVAC systems shall be in accordance with Section 23 08 00 – Commissioning of HVAC.

C. Electrical Commissioning: Commissioning of electrical systems shall be in accordance with Section 26 08 00 – Commissioning of Electrical Systems.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

1. ASHRAE Guideline 1 - The HVAC Commissioning Process.

- B. National Environmental Balancing Bureau (NEBB):
 - 1. NEBB - Procedural Standards for Building Systems Commissioning.
- C. American Water Works Association (AWWA)
 - 1. AWWA Standard C651-05 Disinfecting Water Mains
 - 2. AWWA Standard C653-13 Disinfection of Water Treatment Plants

1.3 COMMISSIONING DESCRIPTION

- A. Commissioning: Systematic process of ensuring systems perform interactively according to design intent and Owner's operational needs. Commissioning process encompasses and coordinates system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training, and verification of actual performance. Commissioning shall be performed by Commissioning Authority, employed by the Contractor. All work related to commissioning and by Commissioning Authority shall be considered incidental to the contract and shall not be measured for payment.
- B. Commissioning Intent:
 - 1. Verify equipment and systems are installed according to manufacturer's instructions, industry accepted minimum standards, and Contract Documents.
 - 2. Verify equipment and systems receive adequate operational checkout by Contractor.
 - 3. Verify and document proper performance of equipment and systems.
 - 4. Verify complete operation and maintenance documentation is delivered to Owner.
 - 5. Verify Owner's operating and maintenance personnel are adequately trained.
- C. Equipment and Systems to be Commissioned:
 - 1. Well pumps, instrumentation, valves, and electrical controls
 - 2. Water treatment equipment:
 - a. Chemical batching and metering.
 - b. Backwash pumping.
 - c. Air scour operation.
 - d. Process instrumentation and controls.
 - 3. Boilers, instrumentation and electrical controls within water treatment plant
 - 4. Hydronic pumps and controls within water treatment plant
 - 5. Hydronic system balancing valves within water treatment plant
 - 6. Glycol heat trace loop for raw water system
 - 7. Electrical heat trace

- D. Commissioning does not relieve Contractor of responsibility to provide finished and fully functioning Project.
- E. Commissioning Process Overview and General Order of Commissioning Tasks:
 - 1. Commissioning begins with initial commissioning meeting.
 - 2. Conduct progress commissioning meetings throughout construction to plan, scope, coordinate, and schedule future activities and to resolve problems.
 - 3. Equipment documentation is submitted to Commissioning Authority during normal submittals with detailed startup procedures.
 - 4. Commissioning Authority works with Contractor and equipment and system installers to develop startup plans and startup documentation formats.
 - 5. Commissioning Authority develops specific equipment and system functional performance test procedures.
 - 6. Contractor executes procedures developed by Commissioning Authority.
 - 7. Items of noncompliance in material, installation, or setup are corrected at Contractor's expense, and system is retested.
 - 8. Commissioning Authority reviews operation and maintenance documentation for completeness.
 - 9. Commissioning is completed before Substantial Completion.
 - 10. Commissioning Authority reviews, approves, and coordinates training provided by Contractor and verifies training was completed.
 - 11. Deferred testing is conducted as specified.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures contains requirements for submittals.
- B. Qualification Data: Submit the following prior to start of Work:
 - 1. Commissioning Authority: Firm or individual name, address, and telephone number, and name of responsible officer.

1.5 COMMISSIONING SUBMITTALS

- A. Commissioning Authority will review and approve submittals for conformance to Contract Documents as related to commissioning process, for primary purpose of aiding development of functional testing procedures and secondary purpose of verifying compliance with equipment Specifications.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements contains requirements for closeout submittals.
- B. Operation and Maintenance Data: Submit operation and maintenance manuals as specified in individual equipment and system Specifications.
 - 1. Submittals made to Commissioning Authority do not constitute compliance with operation and maintenance manual documentation.
- C. Commissioning Record: Commissioning Authority will submit one copy of commissioning record for inclusion in operation and maintenance manuals. Furnish records in following format, arranged by system, with each part separated by tabbed flyleafs:
 - 1. Commissioning plan.
 - 2. Final commissioning report.
 - 3. Provide the following separated by tabbed flyleafs:
 - a. Design narrative and criteria, sequences, and approvals.
 - b. Startup plan and report, approvals, corrections, and blank verification checklists. Separate data for each equipment type with colored separators.
 - c. Completed, functional tests, trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms, and recommended re-commissioning schedule.
- D. Final Commissioning Report: Commissioning Authority will submit one copy of final commissioning report including the following:
 - 1. Executive summary with list and roles of participants, brief Project description, overview of commissioning and testing scope, and general description of testing and verification methods.
 - 2. List outstanding deficiencies referenced to specific functional test, inspection, trend log, or other record where deficiency is documented.
 - 3. Include brief description of verification method used as well as observations and conclusions from testing for each commissioned piece of equipment and system.

1.7 QUALITY ASSURANCE

- A. Perform Work according to references listed in Subsection 1.2 – References of this Section.

1.8 QUALIFICATIONS

- A. Commissioning Authority: Individual employed by Contractor or subcontracted firm specializing in performing Work of this Section with documented experience of commissioning at least 3 projects similar to the scope of this project. Multiple individuals with specific experience commissioning the various systems may operate under the direction of the Commissioning Authority.
 - 1. Individuals performing commissioning duties under Commissioning Authority must be experienced in operation and troubleshooting of the system being commissioned. At a minimum experience in operation and troubleshooting of mechanical, process, electrical systems, and HVAC systems is required.
 - 2. Knowledgeable in test and balance of glycol and water systems.
 - 3. Experienced in monitoring and analyzing system operation using energy management control system trending or standalone data-logging equipment.
 - 4. Excellent verbal and written communication skills, highly organized, and able to work with both management and installers.

1.9 COMMISSIONING SERVICES

- A. Contractor shall employ and pay for services of Commissioning Authority acceptable to Owner to perform specified commissioning.

1.10 COMMISSIONING RESPONSIBILITIES

- A. Responsibilities indicated for Owner, Engineer, and Commissioning Authority are provided only to clarify commissioning process.
- B. Engineer Responsibilities:
 - 1. Perform Site observation of each system before system startup.
 - 2. Furnish design narratives and sequence documentation requested by Commissioning Authority.
 - 3. Clarify operation and control of commissioned equipment when Specifications, control drawings, or equipment documentation is not sufficient for writing detailed testing procedures.
 - 4. Coordinate resolution of design issues affecting system performance identified during commissioning.
 - 5. Coordinate resolution of system deficiencies identified during commissioning, according to Contract Documents.
 - 6. Prepare and submit final design intent documentation reflecting installed conditions for inclusion in operation and maintenance manuals.
 - 7. Review and approve operation and maintenance manuals.

8. Review verification checklists for major pieces of equipment.
9. Review functional test procedure forms for major pieces of equipment.

C. Commissioning Authority Responsibilities:

1. Basic Responsibilities:

- a. Coordinate, direct, and approve commissioning Work.
- b. Develop and coordinate execution of commissioning plan. Revise commissioning plan to suit Project conditions.
- c. Schedule commissioning Work with Contractor for inclusion in Progress Schedule.
- d. Plan and conduct commissioning meetings.
- e. Request and review commissioning submittals required to perform commissioning tasks.
- f. Develop verification check and startup plan in cooperation with Contractor and equipment and system installers.
- g. Write functional performance test procedures in cooperation with Contractor and equipment and system installers.
- h. Review test and balance execution plan.
- i. Attend Project progress meetings as required. Review meeting minutes. Resolve potential conflicts with commissioning activities.
- j. Observe equipment and system installations.
- k. Document that equipment and systems are installed and perform according to design intent and Contract Documents.
- l. Notify Engineer of deficiencies.
- m. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
- n. Oversee and approve content and adequacy of Owner's personnel training.
- o. Review and approve operation and maintenance manuals.
- p. Compile commissioning record and testing data manual.
- q. Provide final commissioning report.

2. Detailed Responsibilities:

- a. Witness and document each piping, electrical, and HVAC system testing, cleaning, and flushing. Include documentation in operation and maintenance manuals.
 - b. Approve verification tests and checklist completion by reviewing verification checklist reports, Site observation, and spot checking.
 - c. Approve system startup by reviewing startup reports and Site observation.
 - d. Oversee functional testing of control system. Approve control system for use for test and balance operations.
 - e. Approve air and water system balancing by reviewing completed reports, Site observation, and spot testing.
 - f. Analyze functional performance trend logs and monitor data to verify performance.
 - g. Coordinate, witness, and approve manual functional performance tests performed by equipment and system installers.
- 1) Coordinate retesting until satisfactory performance is achieved.

- 2) Perform actual functional testing on equipment as specified in Section 23 08 00 - Commissioning of HVAC and Section 26 08 00 Commissioning of Electrical Systems.
- h. Maintain deficiency and resolution log and separate testing record. Submit progress reports and test results with recommended actions to Owner.
- i. Review equipment warranties to ensure Owner's responsibilities are defined.
- j. Return to Site minimum of two months before expiration of warranty period.
 - 1) Review with Owner's personnel the current equipment and system operation and condition of outstanding issues related to original and seasonal commissioning.
 - 2) Interview Owner's personnel to identify problems or concerns regarding equipment and system operation.
 - 3) Make suggestions for improvements and for recording changes in operation and maintenance manuals.
 - 4) Identify deficiencies covered by warranty or original construction contract.
 - 5) Assist Owner's personnel to develop reports, documents, and requests for services to remedy outstanding problems.
3. Commissioning Authority may not:
 - a. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Approve or accept any portion of the Work.
 - c. Assume duties of Engineer.
- D. Owner Responsibilities:
 1. Arrange for Owner's personnel to attend commissioning activities and training sessions according to commissioning plan.
 2. Approve commissioning Work completion.
 3. Ensure seasonal or deferred testing and deficiency issues are addressed.
- E. Contractor Responsibilities:
 1. Include requirements for commissioning submittal data, operation and maintenance data, commissioning tasks and training in each purchase order and subcontract for equipment and systems indicated to be commissioned.
 2. Facilitate coordination of commissioning Work by Commissioning Authority.
 3. Attend commissioning meetings.
 4. Cooperate with Commissioning Authority, and provide access to the Work and to manufacturers' facilities.
 5. Require equipment and system installers to execute test to review and provide comments on functional test procedures.
 6. Require manufacturers to review commissioning test procedures for equipment installed by manufacturer.

7. Furnish proprietary test equipment required by manufacturers to complete equipment and system tests.
8. Provide temporary facilities as specified in Section 01 50 00 - Temporary Facilities and Controls for Commissioning Authority's exclusive use for documentation and instrument storage and preparation of reports.
9. Furnish qualified personnel to assist in completing commissioning.
10. Furnish manufacturer's qualified field representatives as specified in Section 01 40 00 - Quality Requirements and individual Specification Sections to assist in completing commissioning.
11. Ensure equipment and system installers execute commissioning responsibilities according to Contract Documents and Progress Schedule.
12. Coordinate Owner's personnel training.
13. Prepare operation and maintenance manuals specified in Section 01 70 00 - Execution and Closeout Requirements. Update original sequences of operation reflecting actual installation.
14. Ensure equipment and system installers execute seasonal and deferred functional performance testing, witnessed by Commissioning Authority.
15. Ensure equipment and system installers correct deficiencies and make necessary adjustments to operation and maintenance manuals and record documents for issues identified in seasonal testing.

1.11 COMMISSIONING MEETINGS

- A. Section 01 30 00 - Administrative Requirements contains requirements for progress meetings.
- B. Commissioning Authority will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Initial Commissioning Meeting:
 1. Commissioning Authority will schedule meeting within 30 days after start of construction.
 2. Attendance Required: Commissioning Authority, Owner, Engineer, Contractor, Subcontractors, and testing, adjusting, and balancing personnel. Require attendance by installers of the following equipment and systems indicated to be commissioned, including:
 - a. Mechanical equipment and systems.
 - b. Plumbing equipment and systems.
 - c. Electrical equipment and systems.
 3. Agenda:
 - a. Designation of personnel representing parties for commissioning activities.
 - b. Review commissioning process and responsibilities.
 - c. Review commissioning plan development procedures.

- d. Review required commissioning submittals.
 - e. Present initial commissioning schedule.
- D. Progress Commissioning Meetings:
 - 1. Commissioning Authority will schedule meetings throughout progress of the Work at regular intervals.
 - a. Before commissioning of individual systems: meetings shall be scheduled weekly for the two weeks immediately preceding commissioning.
 - 2. Attendance Required: As specified for initial commissioning meeting.
 - 3. Agenda:
 - a. Coordination of commissioning activities.
 - b. Commissioning deficiency resolution.
 - c. Commissioning schedule.
 - d. Planning for future commissioning activities.
- E. Commissioning Authority will record meeting minutes and distribute copies within five days after meeting to participants and those affected by decisions made.

1.12 COMMISSIONING REPORTS

- A. Commissioning Authority Reports: Submit reports regularly to Owner, Engineer, and Contractor. Include the following.
 - 1. Progress reports.
 - 2. Scheduling changes.
 - 3. Observation reports of specific commissioning activities.
 - 4. Testing progress and approvals.
 - 5. Deficiencies and deficiency resolution reports.
- B. Commissioning Authority Functional Performance Test Procedures: Develop test procedures including forms with following information. Include completed documentation in operation and maintenance manuals.
 - 1. System and equipment or component names.
 - 2. Equipment location and identification number.
 - 3. Unique test identification number and reference to unique verification checklist and startup documentation identification numbers for piece of equipment.
 - 4. Date.
 - 5. Project name.

6. Participating parties.
7. Copy of Specification Section describing test requirements.
8. Copy of specific sequence of operations or other specified parameters being verified.
9. Formulas used in calculations.
10. Required pre-test field measurements.
11. Instructions for setting up test.
12. Special cautions, alarm limits, and safety concerns.
13. Specific step-by-step procedures to execute test, in clear, sequential, and repeatable format.
14. Acceptance criteria of proper performance with "Yes/No" check box to allow for marking whether or not proper performance of each part of test was achieved.
15. Section for comments.
16. Signatures and date block for Commissioning Authority.

1.13 SEQUENCING

- A. Section 01 10 00 - Summary contains requirements for sequencing.
- B. Sequence Work to complete commissioning, except for functional testing and Owner's personnel training, before Substantial Completion.
- C. Sequence Work to achieve functional completion before final completion. Complete the following for each piece of equipment and system indicated to be commissioned to achieve functional completion:
 1. Complete and sign startup and verification checklist documentation.
 2. Submit trend log data.
 3. Submit final approved test and balance report.
 4. Complete functional testing.
 5. Complete training of Owner personnel.
 6. Submit approved operation and maintenance data manuals.
 7. Correct identified deficiencies or obtain approval by Owner to exclude deficiencies from functional completion.
- D. For equipment or systems requiring seasonal operation, perform commissioning for other season by October 1 (winter operation) or April 15 (summer operation).

1.14 SCHEDULING

- A. Section 01 30 00 - Administrative Requirements contains requirements for scheduling.
- B. Schedule Work to allow adequate time for commissioning activities.
- C. Identify commissioning milestones, activities, and durations on Progress Schedule.
 - 1. Identify the following for each piece of equipment and system including:
 - a. Operation and maintenance manual submittal.
 - b. Verification check and startup.
 - c. Functional performance test.
 - d. Functional completion.
 - e. Demonstration and training sessions.
 - f. Commissioning completion.

1.15 MAINTENANCE MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements contains requirements for maintenance materials.
- B. Furnish one set of manufacturer's proprietary test equipment, tools, and instruments required to complete commissioning.
 - 1. Deliver test equipment to Owner after completion of functional performance test. Obtain signed receipt.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Testing Equipment: Calibrated within last year; of sufficient quality and accuracy to test and measure system performance within the following tolerances unless otherwise specified for individual equipment or systems.
 - 1. Temperature Sensors and Digital Thermometers: 0.5 degrees F accuracy and plus or minus 0.1 degrees F resolution.
 - 2. Pressure Sensors: Accuracy of plus or minus 2.0 percent of measured value range.
- B. Recalibrate test equipment according to manufacturer's recommended intervals and when dropped or damaged.
 - 1. Affix calibration tags to test equipment or furnish certificates upon request.

- C. Equipment Furnished by Contractor and Remaining Property of Contractor:
 - 1. Standard testing equipment required to perform verification check and startup and required functional performance testing.
 - 2. Two-way radios or other acceptable communication device for personnel performing commissioning.
- D. Equipment furnished by Commissioning Authority and remaining property of Commissioning Authority:
 - 1. Data-logging equipment and software.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements contains requirements for verification of existing conditions before starting Work.
- B. Verify equipment and systems are installed according to individual Specification Sections.
- C. Verify utility and power connections are complete and services operational.

3.2 VERIFICATION CHECK AND STARTUP PROCEDURES

- A. Notify Commissioning Authority and schedule verification check and startup activities with each party required to complete verification check and startup a minimum of two weeks in advance.
- B. Allow Commissioning Authority to witness verification check and startup.
 - 1. Primary Equipment: Commissioning Authority will witness procedures for each piece of equipment.
 - 2. Secondary Equipment: Commissioning Authority will witness procedures for each piece of equipment.
- C. Verification Check and Startup:
 - 1. Perform verification check and startup according to approved verification check and startup plan.
 - 2. Complete entire plan for each piece of equipment or system indicated to be commissioned.
 - 3. Complete each procedure in sequence performed by party assigned to each procedure.

4. Record completion of each procedure. Indicate results of procedure where required. Sign and date plan by individual performing procedure.
5. Identify items not completed successfully.
6. Sign and date plan indicating completion of entire plan.
7. Submit executed plan to Commissioning Authority within two days of completion.

D. Deficiencies and Approvals:

1. Commissioning Authority will review verification check and startup reports and issue deficiency report or approval.
2. Correct deficiencies and resubmit updated verification check and startup report with statement indicating corrections made for Commissioning Authority approval.
3. Repeat process until verification check and startup report are approved.
4. Costs for incomplete verification check and startup items that later cause deficiencies or delays during functional tests may be charged to party responsible for incomplete item.

3.3 FUNCTIONAL PERFORMANCE TEST PROCEDURES

A. Complete the following before performing functional tests:

1. Verification check and startup.
2. Control system testing with approval by Commissioning Authority for use for test and balance operations.
3. Glycol heating system balancing.

B. Notify Commissioning Authority of completion of verification check and startup activities.

C. Commissioning Authority will direct, witness, and document results of functional performance tests.

D. Conduct functional performance tests as specified in Section 23 08 00 - Commissioning of HVAC and 26 08 00 – Commissioning of Electrical Systems.

E. Demonstrate that each piece of equipment and system is operating according to documented design intent and Contract Documents.

1. Conduct testing proceeding from components, to subsystems, to systems.
2. Bring equipment and systems to condition capable full dynamic operation.
3. Verify performance of individual components and systems.
4. Verify performance of interactions between systems.
5. Identify and correct areas of deficient performance.

- F. Operate each piece of equipment and system through each specified mode of operation including seasonal, occupied, unoccupied, warmup, cool-down, partial load, and full load conditions.
 - 1. Verify each sequence in sequences of operation.
 - 2. Test for proper responses to power failure, freezing, overheating, low oil pressure, no flow, equipment failure, and other abnormal conditions.

3.4 FUNCTIONAL PERFORMANCE TEST METHODS

- A. Perform testing and verification by using manual testing or by monitoring performance and analyzing results using control system trend log capabilities or by standalone data loggers as specified for each piece of equipment or system.
 - 1. Commissioning Authority may require alternate or additional method other than specified method.
 - 2. Commissioning Authority will determine test method when method is not specified.
- B. Simulated Conditions: Simulating conditions, not by overwritten values, is permitted. Timing tests to use real conditions is encouraged wherever practical.
- C. Overwritten Values: Overwriting sensor values to simulate conditions may be used with caution and avoided when possible.
- D. Simulated Signals: Using signal generator to create simulated signals to test and calibrate transducers automatic temperature controls is generally recommended over using sensors as signal generators with simulated conditions or overwritten values.
- E. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test specific sequence is acceptable. Reset setpoint after completing test.
- F. Indirect Indicators: Using indirect indicators for responses or performance is permitted only after visually and directly verifying and documenting indirect readings through control system representing actual conditions and responses over tested parameter range.
- G. Perform each function and test under conditions simulating actual conditions as close as is practically possible.
 - 1. Provide materials, system modifications, and other items or steps necessary to produce flows, pressures, temperatures, and other responses to execute test according to specified conditions.
 - 2. At completion of test, return modified equipment and systems to pretest condition.

3.5 DEFICIENCIES AND TEST APPROVALS

A. Deficiencies:

1. Commissioning Authority will record and report deficiencies to Owner.
2. Minor deficiencies may be corrected during tests at Commissioning Authority's discretion. Deficiency and resolution will be documented on procedure form.
3. Failure to attend scheduled verification check, startup, or functional performance test will be considered deficiency.
4. When deficiency is identified, Commissioning Authority will discuss issue with party executing test.
 - a. When party executing test accepts responsibility to correct deficiency:
 - 1) Commissioning Authority documents deficiency and executing party's response.
 - 2) Commissioning Authority submits deficiency report to Owner, Contractor, and party executing test.
 - 3) Party executing test corrects deficiency, signs statement of correction on deficiency form certifying equipment is ready for retesting, and submits form to Commissioning Authority.
 - 4) Commissioning Authority reschedules test, and test is repeated until satisfactory performance is achieved.
 - b. When party executing test disputes deficiency or responsibility for deficiency:
 - 1) Commissioning Authority documents deficiency and executing party's response.
 - 2) Commissioning Authority submits deficiency report to Owner, Contractor, party executing test, and party believed to be responsible for deficiency.
 - 3) Commissioning Authority refers disputes to Engineer for resolution according to Contract Documents.
 - 4) Commissioning Authority documents resolution process.
 - 5) When resolution is decided, appropriate party corrects deficiency, signs statement of correction on deficiency form certifying equipment is ready for retesting, and submits form to Commissioning Authority.
 - 6) Commissioning Authority reschedules test, and test is repeated until satisfactory performance is achieved.

B. Retesting Costs:

1. When verification check and startup or functional performance test deficiency is discovered requiring rescheduling or retesting:
 - a. Owner will compensate Commissioning Authority (when not an employee of Contractor), and Engineer for attending and directing additional testing.
 - b. Owner will deduct additional testing compensation from final payment due to Contractor.

- C. Provide written report to Commissioning Authority before each scheduled commissioning meeting concerning status of each deficiency. Include explanations of disagreements with resolution proposals for each discrepancy.
 - 1. Commissioning Authority will retain original deficiency forms until end of Project.
- D. Manufacturing Defects: When two or more identical pieces of equipment or fail to perform to Contract Document requirements due to manufacturing defect, all identical units may be considered defective by Owner.
 - 1. Within one week of notice from Owner, examine all other identical units and record findings. Submit findings to Owner within two weeks of original notice.
 - 2. Within two weeks of original notification, provide signed and dated written explanation of problem, cause of defect, and proposed solutions meeting Contract Document requirements. Include equipment submittals supporting solution.
 - 3. Owner will determine whether replacement or repair of all identical units is required.
 - 4. Provide a minimum of two examples of proposed solution. Owner will review proposed solutions and decide which solution is acceptable.
 - 5. Upon acceptance, replace or repair all identical items, at Contractor's expense. Extend warranty accordingly, when original equipment warranty had begun.
 - 6. Complete repairs or replacements with reasonable speed beginning within one week from when parts can be obtained.
- E. Test Approval: Commissioning Authority notes each satisfactorily demonstrated function on functional performance test form.
 - 1. Commissioning Authority recommends acceptance of each test to Owner using standard form.
 - 2. Owner gives final approval for each test using same form, providing signed copy to Commissioning Authority and Contractor.

3.6 DEMONSTRATION

- A. Section 01 70 00 - Execution and Closeout Requirements contains requirements for demonstration and training.
- B. Demonstrate equipment and systems and train Owner's personnel as specified in individual equipment and system Specifications.
 - 1. Commissioning Authority will interview Owner's personnel to determine special needs and areas where training will be most valuable.
 - 2. Owner and Commissioning Authority will determine type and extent of training for each commissioned piece of equipment and system.

3. Commissioning Authority will communicate training requirements to Contractor for benefit of equipment and system installers and manufacturers with training responsibilities.
- C. Commissioning Authority will develop criteria for determining training was satisfactorily completed, including attending some training sessions.
1. Commissioning Authority will make recommendation to Owner regarding approval of training.
- D. Initial Equipment Training Session:
1. Engineer will make a presentation of overall system design concept and design concept of each equipment section.
 2. Presentation will include review of the following systems using simplified system schematics:
 - a. Well pumps, valves, and electrical controls
 - b. Water treatment process
 - c. Boilers and electrical controls within water treatment plant
 - d. Hydronic pumps and controls within water treatment plant
 - e. Hydronic system balancing valves within water treatment plant
 - f. Glycol heat trace loop for raw water system
 - g. Electrical heat trace
- E. For primary equipment training:
1. Require controls contractor to provide short discussion of equipment control as part of training session.
- F. Commissioning Authority will make video recording of training sessions, catalog recordings, and furnish one set of recordings for inclusion with operation and maintenance manuals.

END OF SECTION

DIVISION 02 EXISTING CONDITIONS

**SECTION 02 01 00
MAINTENANCE OF EXISTING CONDITIONS**

PART 1 - GENERAL

1.1 PUBLIC AND PRIVATE UTILITIES

- A. Existing above-ground utilities, including but not limited to power transmission and distribution, telephone, water and sewer piping, fuel piping, glycol heat trace, and private utility service lines, whether shown on the Plans or not, shall be protected, maintained, relocated, rerouted, removed and restored as may be necessary by Contractor in a manner satisfactory to Owners and operators of the utilities.
- B. Major underground utilities and appurtenant structures, whether shown on the Plans or not, shall be protected, maintained, relocated, rerouted, removed and restored by the Contractor.
- C. Minor underground utility service lines, including but not limited to sanitary sewer services, fuel pipelines, water services, house or yard drains, and electricity or telephone services and driveway culverts shall be protected, maintained, relocated, rerouted, removed and restored by the Contractor with the least possible interference with such services and in no case shall the interference of such service lines be considered for extra compensation under any of the special cases listed above.
- D. Public Utilities:
 - 1. The right is reserved by Owner of public utilities and franchises to enter upon any street, road, right-of-way, or easement for the purpose of maintaining their property and for making necessary repairs or adjustments caused by the Contractor's operations.
 - 2. The Contractor shall save the Owner harmless of any costs so incurred.

1.2 RESTORATION OF DRAINAGE FACILITIES

- A. Where it is necessary for drainage facilities to be removed and replaced, existing culverts may be reinstalled when approved by the agency(s) having jurisdiction unless identified in drawings to be replaced.
- B. The materials shall be cleaned.
- C. When it is necessary to replace existing culverts, the new materials shall be of equal strength and similar design to existing materials, unless otherwise noted.
- D. Installation shall be in accordance with the applicable provisions of these specifications.

- E. All costs, whether new or existing facilities are installed, shall be considered to be included in the unit prices bid for the various items and no additional payment shall be allowed.

1.3 QUALITY ASSURANCE

- A. All work shall be performed in conformance with regulations pertaining to safety established by the applicable Federal, state, or local agencies, and as may be specified elsewhere in these specifications.
- B. Underground Facilities:
 - 1. It is recommended that the Contractor make arrangements with the applicable utility company or department to aid in the location and maintenance of existing utilities.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 02 22 00 EXISTING CONDITIONS ASSESSMENT

PART 1 - GENERAL

1.1 SITE VISITATION

- A. Contractors shall visit the site of work, existing buildings, review any available existing drawings, and all conditions affecting the work of this project before providing a bid proposal.
- B. Contractors desiring access to existing buildings shall contact the Engineer to arrange appointments. No guarantees are made that appointments to visit all facilities will be available. The Owner reserves the right to provide access to all potential bidders at one time at the Owner's convenience.

PART 2 - VERIFICATION

2.1 CONSTRUCTION

- A. Prior to commencement of work, verify all existing conditions, control points, principal lines and elevations, presence of underground utilities, at or related to the site and existing buildings, and also examine all adjacent facilities upon which the work is in any way dependent. In the event of any inconsistency or conflict, between existing conditions and the bidding documents, immediate notice of such inconsistency or conflict shall be given to the Engineer. Do not undertake any phase of the work affected by such inconsistency or conflict, pending the issuance of instructions by the Engineer.
- B. Some of the elevations of existing grades, floors, tops of walls, parapets, beams and locations of existing columns, walls, pipe foundations, utility boxes and the like are based on drawings of the existing building furnished by the Owner. It is the intent of the Contract Drawings to integrate new work with existing work and the Contractor shall verify actual conditions.
- C. Provide protections necessary to prevent damage to existing buildings, improvements, landscaping and trees, parking, streets walks, etc. to remain in place. Restore damaged buildings, improvements, etc. to their original conditions as acceptable to the Owner.

PART 3 - EXISTING CONDITIONS

3.1 EXISTING FACILITIES

- A. Existing buildings must be kept functioning during the construction period.

- B. Existing utilities cannot be disconnected until new ones have been installed and completely tested and approved unless otherwise approved by the Engineer. Existing functioning utilities cannot be interrupted without written approval from the Owner. Give two (2) weeks written notice to the Engineer prior to planned interruption of any existing functioning utilities. Engineer will then schedule with Contractor for date and time of shutdown. Due to the need for continuous operation of the facilities, no guarantee is made that scheduled shutdowns can be accommodated.
- C. Notify the Engineer when working in areas where utility lines might be encountered.

END OF SECTION

**SECTION 02 32 00
GEOTECHNICAL INVESTIGATIONS**

PART 1 - GENERAL

1.1 SOIL REPORTS

- A. Geotechnical information for this project and provided in these Contract Document was obtained from the following source: 1) Draft Geotechnical Report - Unalakleet Water Source, CRW Engineering Group, LLC, February 2021.
- B. Additional Investigation:
 - 1. Contractor shall visit the site and acquaint himself with site conditions before submitting a bid, and the submission of a bid will be prima facie evidence that he has done so.
 - 2. Prior to bidding, Contractor may make his own subsurface investigations to satisfy himself with site and subsurface conditions.

1.2 QUALITY ASSURANCE

- A. The Contractor shall readjust work performed that does not meet technical or design requirements.
- B. The Contractor shall make no deviations from the Contract Documents without specific and written approval of the Owner.
- C. The Contractor shall be responsible for obtaining approval from responsible agency(s) or property owner(s) before performing any exploratory excavations.

END OF SECTION

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolishing designated building equipment and fixtures.
2. Demolishing designated construction.
3. Cutting and alterations for completion of the Work.
4. Removing designated items for disposal, relocation, or Owner's retention.
5. Protecting items designated to be relocated.
6. Removing demolished materials.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

C. Shop Drawings:

1. Indicate demolition and removal sequence.
2. Indicate location of items designated for disposal, relocation, or Owner's retention.
3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition and foundation obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

A. Obtain required permits from authorities having jurisdiction.

- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.
- D. Pre-demolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalized protection requirements.
 - 5. Review procedures for noise control and dust control.
 - 6. Review procedures for protection of adjacent piping and equipment.

1.5 SEQUENCING

- A. Section 01 10 00 - Summary: Requirements for sequencing.

1.6 SCHEDULING

- A. Section 01 32 16 - Construction Progress Schedule: Requirements for scheduling.
- B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation and temporary outages.
- C. Coordinate utility and building service interruptions with Owner.
 - 1. Do not disable or disrupt life safety systems without three days prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.
 - 3. Coordinate Work to ensure fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.7 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent building areas.
- B. Conduct building demolition so operations of occupied building will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operation of adjacent occupied areas.

2. Maintain access to existing walkways, exits, and other facilities used by occupants of building.
- C. Owner assumes no responsibility for buildings and structures to be demolished.
 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. On-site storage or sale of removed items or materials is not permitted.
- E. Cease operations immediately if structure appears to be in danger and notify Engineer. Do not resume operations until directed.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect and maintain weatherproof closures for exterior openings.
- D. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- E. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- F. Provide appropriate temporary signage including signage for exit or building egress.
- G. Do not close or obstruct building egress paths.
- H. Do not disable or disrupt life safety systems without three days prior written notice to Owner.

3.2 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.

- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.3 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.
- C. Cease operations immediately when structure appears to be in danger and notify Engineer.
- D. Disconnect and remove designated utilities within demolition areas.
- E. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
- F. Demolish in orderly and careful manner. Protect existing improvements and supporting structural members.
- G. Carefully remove building components indicated to be reused.
 - 1. Disassemble components as required to permit removal.
 - 2. Package small and loose parts to avoid loss.
 - 3. Mark components and packaged parts to permit reinstallation.
 - 4. Store components, protected from construction operations, until reinstalled.
- H. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- I. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

J. Remove temporary Work.

END OF SECTION

SECTION 02 43 00 REMOVAL AND RELOCATION

PART 1 – GENERAL

1.1 GENERAL

- A. The Contractor shall be responsible for verifying actual field conditions and determining the work required by inspecting the site prior to bidding.
- B. The tabulation of work and equipment listed hereafter is not intended to be all inclusive, and it shall be the Contractor's responsibility to perform the work shown, specified, or which can reasonably be inferred from the Contract Documents as necessary to complete the project.
- C. Any material damaged by Contractor's operations shall be replaced with new material by the Contractor at the Contractor's expense.

1.2 SUBMITTALS DURING CONSTRUCTION

- A. Submit a storage plan for any and all major materials to be salvaged and/or reused.

1.3 TEMPORARY REMOVAL

- A. General:
 - 1. Construction operations in certain areas may necessitate temporary removal of timber supports, boardwalk, utilities, private accesses, drains, service lines, conduits, and any other existing facilities, to facilitate construction.
 - 2. In the event that the Contractor finds it necessary to remove such items, it is to be particularly understood that it will be his responsibility to restore these items to near pre-construction conditions as possible unless otherwise indicated on the Plans.
 - 3. The Contractor shall maintain adequate temporary provisions for supporting the continued operation of public and private facilities including:
 - a. domestic deliveries;
 - b. utilities service including water and sewer service, heating, electrical power and controls;
 - c. fire protection and access for fire-fighting equipment.
- B. The preceding requirements will be the same for any temporary removal of road culverts, whether under State, City or private jurisdiction.

1.4 RELOCATION

- A. Existing materials and appurtenances shown or required to be relocated or reused shall be removed and relocated and/or reused as part of the Contract.

- B. Materials and equipment to be relocated and/or reused shall be removed in a manner that maintains them in a condition equivalent to their condition before being removed.
- C. The Contractor shall be responsible to safeguard items to be relocated and/or reused against damage and loss during removal, handling, storage, and installation in the new location.

1.5 DEBRIS

- A. Debris is defined as all waste materials resulting from removal, salvage, and relocation operations, and all material in excess of construction requirements, all material not in accordance with the specifications, and all other materials specified or designated by the Owner to be removed from the construction site as may be required to complete the project.
- B. Debris resulting from removal, salvage, and relocation shall include, but not be limited to, all wood, metals, piping, and miscellaneous materials resulting from the removal of structures, pipe foundations, service boxes, and other man-made objects or from removal of subsurface obstacles.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the work shown, specified herein, and as required to complete the project.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. All work shall be performed in conformance with the laws and regulations pertaining to safety established by the applicable Federal, state, or local agencies, and as may be specified elsewhere in these specifications.

3.2 REMOVAL AND SALVAGE

- A. The information shown in the Plans is based on the best available information. Actual conditions encountered in the field regarding structures, equipment, piping, valves and other appurtenances may differ.
- B. The Contractor shall be responsible for determining the effort required for accomplishing the work by inspecting the site and becoming thoroughly familiar with the existing conditions of the work.

- C. Removal shall be limited to the extents shown on the Plans. Should removal beyond the scope shown the Plans be necessary, the Contractor shall obtain the approval of the Engineer prior to the start of Work.
- D. The Contractor shall take precautions so as not to damage the existing structure and adjacent piping, valves, supports and appurtenances beyond what is detailed for removal and shall be responsible for repairing those areas damaged at the Contractor's expense.
- E. The Contractor shall be responsible for the sequence of removal.

3.3 RELOCATION

- A. General:
 - 1. Remove, relocate, and reinstall equipment as shown on the Plans, and as directed.
- B. Inspection:
 - 1. Prior to commencement of relocation work, the Contractor and the Engineer shall make a joint inspection of the physical and operational condition the material specified for relocation and/or reuse and shall note, in writing, the material transferred to the Contractor's care and defects in said equipment.
 - 2. Damage to or loss of equipment and materials after the date of their transfer to the Contractor shall be repaired or replaced at the Contractor's expense.
 - 3. The Contractor shall maintain all equipment in the same condition as it was prior to removal.
 - 4. The condition of the equipment shall be determined by the Engineer with the aid of photographs.
 - 5. The Contractor shall assume the responsibility of assuring that the equipment is properly stored and maintained in a secure area.

3.4 RESPONSIBILITY FOR COMPLETE SYSTEM

- A. The Contractor shall assume complete responsibility for storing, installing, adjusting, lubricating, and maintaining any equipment relocated under this Section.
- B. The Contractor shall be responsible for fully coordinating the construction of interconnecting structures, equipment, piping, and appurtenances.
- C. The Contractor shall make all electrical heat trace connections necessary to complete the work as indicated on the Plans.

3.5 REHABILITATION

- A. General:
 - 1. Certain areas of existing structures, piping, conduits, and the like will be affected by work necessary to complete modifications under this Contract.

2. The Contractor shall rehabilitate those areas affected by his construction activities.
- B. Piping:
 1. Any damage to the surface or coating of the existing piping shall be repaired by the Contractor.
- C. Where existing piping, piping supports, electrical panels and devices, conduits, and associated appurtenances are removed; the Contractor shall rehabilitate the affected area such that little or no evidence of the previous installation remains.

3.6 DISPOSAL OF DEBRIS

- A. All debris, materials, piping, and miscellaneous waste products from the work described in this Section shall be removed from the project as soon as possible.
- B. Disposal shall be in accordance with Section 017419, Construction Waste Management and Disposal.
- C. The Contractor is responsible for determining these regulations and shall bear all costs or retain any profit associated with disposal of these items.

3.7 BACKFILLING

- A. Where excavation is required to accomplish removal, salvage and relocation work as described in this Section, the Contractor shall backfill all such areas approximately to existing ground level, final grade, or foundation level of new construction, as applicable and as may be shown on the Plans.
- B. Backfill material shall be native material excavated from the hole.
- C. Timber sleepers and other construction or vegetative debris shall not be used as backfill material.
- D. In all areas not backfilled to ground level, the Contractor shall erect safety barriers around the excavation.

END OF SECTION

DIVISION 05 METALS

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Shop fabricated ferrous metal items, galvanized and prime painted.

B. Products Furnished But Not Installed Under This Section:

1. Furnish safety nosing to be cast in concrete and installation instruction.

C. References:

1. American Society for Testing and Materials (ASTM):
 - a. A27-85 Steel Castings, Carbon, for General Application.
 - b. A36-84a Structural Steel.
 - c. A47-84 Malleable Iron Castings.
 - d. A53-86 Hot-Dipped, Zinc-coating Welded and Seamless Steel Pipe.
 - e. A167-84 Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip.
 - f. A307-86a Carbon Steel Externally Threaded Fasteners.
 - g. A123-84 Zinc-Coating (Hot-Dip) on Assembled Steel Products.
 - h. A500-84 Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - i. A510-82 General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
 - j. C827-87 Early Volume Change of Cementitious Mixtures.
 - k. D1187-82 Asphalt-Based Emulsions for Use as Protective Coatings for Metal.
2. American Welding Society (AWS) :
 - a. D1.1 Structural Welding Code.
3. Federal Specifications (FS) :
 - a. TT-P-31 Paint, Oil: Iron Oxide, Ready Mix, Red and Brown.
 - b. TT-P-645 Primer, Paint, Zinc Chromate, Alkyd Type.

1.2 QUALITY ASSURANCE

A. Welder's Qualifications:

1. Perform shop and field welds by operators currently certified in tests as prescribed in AWS Qualification Procedure.
2. Submit proof of current certification for each welder employed on Project.

1.3 SUBMITTALS

- A. Submit shop drawings under provision of Section 01340.
- B. Indicate profiles, sizes, connections, attachments, reinforcing, anchorage, size and type of fasteners and accessories.
- C. Include erection drawings, elevations and details where applicable.
- D. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Steel Pipe: ASTM A53, Grade B, Schedule 40 as indicated.
- D. Steel Rod: ASTM A510.
- E. Fasteners:
 - 1. Bolts, Nuts, and Washers: ASTM A307.
 - 2. Lag Bolts: Square head type, FS FF-B-561.
 - 3. Wood screws: Flathead carbon steel, FS FF-S-111.
 - 4. Machine screws: Cadmium plated steel, FS FF-S-92.
 - 5. Plain washers: Round carbon steel, FS FF-W-92.
 - 6. Lock washers: Helical spring type carbon steel, FS FF-W-84.
 - 7. Expansion Bolts: Parabolts, or acceptable substitute.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Primer: FS TT-P-31, for shop application and field touch-up.
- H. Touch-up Primer for Galvanized Surfaces: FS TT-P-645.
- I. Protective Coating: Non-fibrated aluminum paint conforming to ASTM D1187, Type A.
- J. Stainless Steel Plate: ASTM A167, Type 304.

2.2 FABRICATION

- A. Verify dimension on site prior to shop fabrication.
- B. Fabricate items with joints tightly fitted and secured.

- C. Fit and shop assembly in largest practical section, for delivery to site.
- D. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- F. Make exposed joints butt tight, flush, and hairline.
- G. Furnish components required for anchorage of metal fabrications. Fabricate anchorage and related components of same materials and finish as metal fabrication, except where specifically noted otherwise.

2.3 FINISH

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Galvanize items to minimum 1.25 oz/sq ft. zinc coating in accordance with ASTM A123.
- C. Do not prime surface in direct contact bond with concrete, or where field welding or sprayed fireproofing is required.
- D. Prime paint scheduled items with one coat except two coats on surfaces inaccessible after assembly or erection. Change color of second coat to distinguish from first coat.
- E. Stainless Steel: Polished and buffed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Obtain Owner's acceptance prior to site cutting or making adjustments not scheduled.
- B. Clean and strip site primed steel items to bare metal where site welding is scheduled.
- C. Make provision for erection loads with temporary bracing. Keep work in alignment.
- D. Furnish items required to be cast into concrete with setting templates, to appropriate Sections.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion and defects.
- B. Perform field welding in accordance with AWS D1.1.
- C. After installation, touch-up field welds, scratched or damaged surfaces with primer and touch-up primer as applicable.

END OF SECTION

DIVISION 06 WOOD, PLASTICS, & COMPOSITES

SECTION 06 13 00**HEAVY TIMBER****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes preservative-treated heavy structural timber for posts, beams and connection hardware.
- B. Related Sections:
 - 1. Section 05 50 00 – Metal Fabrications: Structural steel connectors.
 - 2. Section 06 10 63 – Exterior Rough Carpentry: Structural dimension lumber framing.
 - 3. Section 06 15 00 – Wood Decking.

1.02 REFERENCES

- A. American Institute of Timber Construction:
 - 1. AITC 108 - Standard For Heavy Timber Construction.
- B. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- C. American Wood-Preservers' Association:
 - 1. AWP A M4 - Standard for the Care of Preservative-Treated Wood Products.
 - 2. AWP A U1 - Use Category System: User Specification for Treated Wood.
- D. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- E. The Redwood Inspection Service:
 - 1. RIS - Standard Specifications for Grades of California Redwood Lumber.
- F. Southern Pine Inspection Bureau:
 - 1. SPIB - Standard Grading Rules for Southern Pine Lumber.
- G. U.S. Department of Commerce National Institute of Standards and Technology:
 - 1. DOC PS 1 - Construction and Industrial Plywood.
 - 2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.

3. DOC PS 20 - American Softwood Lumber Standard.
 - H. West Coast Lumber Inspection Bureau:
 1. WCLIB - Standard Grading Rules for West Coast Lumber.
 - I. Western Wood Products Association:
 1. WWPA G-5 - Western Lumber Grading Rules.

1.03 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on proprietary connection devices. Submit technical data on wood preservative materials.

1.04 QUALITY ASSURANCE

- A. Perform welding Work in accordance with AWS D1.1.
- B. Lumber Grading Agency: Certified by DOC PS 20.

PART 2 - PRODUCTS

2.01 HEAVY TIMBER FRAMING

- A. Lumber Grading Rules: WCLIB or WWPA G-5.
- B. Lumber: Beams and Stringers, Douglas Fir Larch species; No. 1 grade (or better for specific components—see Drawings); maximum moisture content of 19 percent.

2.02 FASTENERS AND ANCHORS

- A. Fasteners:
 1. Bolts shall conform to ASTM A307.
 2. Wood Screws, Lag Screws and Lag Bolts shall conform to ANSI/ASME B18.6.1.
 3. Nails shall conform to Table 2304.9.1 of the International Building Code (IBC).

2.03 ACCESSORIES

- A. Manufactured Connectors: Galvanized steel; manufactured by Simpson Strong-Tie or approved equal.
- B. Shop-Fabricated Connectors: Specified in Section 05 50 00.
- C. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; galvanized coating; size and type to suit application and resist imposed loads.
- D. Barrier Membrane: Membrane barrier shall be cross-laminated HDPE having a minimum thickness of 25 mils and specifically manufactured for the purpose of providing separation between steel components and wood treated with copper-based preservatives. The membrane barrier materials shall have rubberized asphalt adhesive with a paper release liner.
- E. Zinc Chromate Primer.

2.04 FABRICATION

- A. Fabricate components in accordance with AITC 108, with joints neatly fitted, welded and ground smooth. Account for shrinkage of timber in design and arrangement of fasteners for connections.

2.05 FINISHES

- A. Timber Surfaces: S4S.
- B. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.
- C. Galvanizing for Nuts, Bolts and Washers: ASTM A153/A153M.

2.06 WOOD TREATMENT

- A. Wood Preservative (pressure treatment for all exterior wood): AWWA U1, Commodity Specification A-Sawn Products or F-Wood Composites using water-borne copper azole, Type C (CA-C) preservative for UC4B use category.
- B. Wood Preservative (surface application for cuts and holes in pressure-treated wood): approved copper naphthenate product.
- C. Moisture Content after Treatment: Kiln dried (KDAT), maximum 19 percent.

PART 3 - EXECUTION**3.01 ERECTION**

- A. Set structural timber framing level and plumb, in correct position.
- B. Install structural timbers with minimum ½-inch clearance around timbers set into concrete or masonry for air circulation.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in indicated alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect/Engineer.
- E. After erection, touch-up galvanized surfaces with zinc primer.

3.02 SITE-APPLIED WOOD TREATMENT

- A. Brush-apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings.
- B. Treat site-sawn cuts. Apply preservative to site-sawn cuts in accordance with AWWA M4.
- C. Allow preservative to cure prior to erecting members.

3.03 FIELD QUALITY CONTROL

- A. Welding: Inspect welds in accordance with AWS D1.1.

END OF SECTION

DIVISION 13 SPECIAL FACILITY COMPONENTS

SECTION 13 34 23**FIBERGLASS REINFORCED POLYMER (FRP) SHELTER****PART 1 - GENERAL****1.1 SYSTEM DESCRIPTION**

- A. Shelter Name: Well House
 - 1. Size:
 - a. Exterior Width: 10 ft
 - b. Exterior Length: 10 ft
 - c. Wall Height: 8 ft
 - 2. Roof Slope: Sufficient to allow rain drainage, 12° – 17° pitch.
 - 3. Roof Type: Roof shall be wind-resistant “hip” design sloping up from all four sides. Roof shall form a permanent weather-proof connection with a seamless exterior appearance that uses low-maintenance silicone caulk matching the shelter’s exterior color.
 - 4. Roof deck is compliant with ASTM E 108/ULC S107 (class C) with <13’ Flame Spread.
 - 5. Roof shall not overhang walls in order to maximize shelter’s wind speed rating.
- B. System: Design, furnish, and install complete package using manufacturer’s standard components.
- C. Structure Type: Fiberglass Reinforced Polymer (FRP) shelter on a formed and poured concrete pad as specified herein.
- D. Submittals: Shelter vendor to provide one (1) digital version of shop drawings and manufacturer’s data including the following:
 - 1. Dimensions, weight, materials, parts, devices, and all other information required to verify compliance with these Specifications.
 - 2. Manufacturer’s Literature and Technical Data: Drawings and Specifications for proposed system.
 - 3. Drawings prepared specifically for this Project:
 - a. Materials and Details: Show materials, details of components (including doors and other accessories), finishes, fastenings, methods of joining, sealants, anchor bolt details, structural members and bracing, and openings.
 - b. Anchorage details of structure to foundation.
 - c. Drawings shall be sealed by an Alaska State Registered Professional Engineer responsible for the design.
 - 4. Structural Calculations sealed by an Alaska State Registered Professional Engineer responsible for the design.
- E. Operations and Maintenance (O&M) Manual including installation instructions, digital version only, to be provided after shelter ships.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:

- a. Longevity: At least 10 years' experience in work of the type required in this section.
- b. Capacity: Production throughput sufficient to provide work required for this Project without delay.
- c. Certified Test Results: The manufacturer shall have an entire fiberglass panel destructive tested by an accredited Testing Laboratory and Third Party Quality Control Agency and upon request shall furnish to the engineer the certified and stamped test results of the laboratory testing. The accredited Testing Laboratory must be accredited to ISO 17020 and 17025.
- d. Quality: The manufacturer shall maintain a quality assurance program that is reviewed and approved by a Third Party Quality Control Agency.

2. Erector/Installer:

- a. Not less than 2 years' experience in the offloading and installation of prefabricated structures.

B. Material Properties:

1. Fiberglass Laminate Properties:

- | | |
|---|-----------------|
| a. Tensile Strength (ASTM D 638) | 16,000 (psi) |
| b. Flexural Strength (ASTM D 790) | 33,700 (psi) |
| c. Flexural Modulus (ASTM D 790) | 1,160,000 (psi) |
| d. Tensile Modulus (ASTM D 638) | 1,300,000 (psi) |
| e. Barcol Hardness | 45 |
| f. Izod Impact – Notched ((ft.-lbs)/in) | 16.30 |
| g. Izod Impact – Unnotched ((ft.-lbs)/in) | 21.79 |

2. Foam shall be rigid closed cell, polyisocyanurate with a density of 1.5 – 1.9 pounds per cubic foot.

- | | |
|----------------------------------|------|
| a. Flame Spread (ASTM E 84) | <75 |
| b. Smoke Development (ASTM E 84) | <450 |

1.3 DELIVERY, STORAGE, AND HANDLING

- A. The fiberglass shelter and the accessory items shall be carefully transported, stored, handled and set in place in a manner that will prevent distortion, misalignment or other damage to the units.
- B. During storage prior to installation and following installation, but prior to placing in service, the manufacturer's recommendations regarding handling shall be followed.

1.4 MANUFACTURERS WARRANTY

- A. Manufacturer shall provide a five (5) year warranty on the shelter materials and workmanship, according to the following specifications:
 - 1. The shelter will be free from manufacturing defects in workmanship and will not appreciably deteriorate under conditions of normal use and regular service and maintenance when installed properly, for a period of five (5) years from the original date of purchase.
 - 2. Component parts will be purchased from reputable manufacturers and carry their own warranties.
 - 3. Any shelter penetrations made by shelter manufacturer must be maintained by the Customer to ensure proper sealing. Suggested intervals is every (2) two years. All penetrations made by the Customer during shelter installation are the responsibility of the Customer and may void or limit the warranty if done improperly.

PART 2 - PRODUCTS

2.1 SHELTER MANUFACTURERS

- A. Product from Shelter Works, St. Louis, MO as represented by Wm. H. Reilly & Co. (503-223-6197), meeting these Specifications, or approved equal, may be used on this Project.
- B. Products from other manufacturers will be considered for substitution. Requests for substitution must include the following information in order to be considered:
 - 1. Formal written request certifying that products to be substituted will match specified products in terms of structural properties, dimensions, physical appearance, quality level and quantities and that they will perform the same function in the same manner and will achieve the same end result.
 - 2. Manufacturer's and supplier's material data sheets, specifications and performance data.
 - 3. A list of twenty (20) projects in satisfactory service for not less than three years with shelters similar to those being proposed for substitution. For each project, include name, address and telephone number of the engineer, the contractor and the plant manager.

2.2 SYSTEM PERFORMANCE - STRUCTURAL LOADING

- A. Shelter: Building dead load.
- B. Roof Live Load: 20 psf
- C. Roof Snow Load: 40 psf
- D. Ultimate Wind Speed: 164 mph
- E. Nominal Wind Speed: 127 mph
- F. Seismic Load:
 - 1. $S_s=0.376$ $S_I=0.148$ Seismic Importance Factor = 1.5, Category IV Site Class = D

2.3 COMPONENTS

- A. U-BOLTS. Through-wall lifting/tie-down eyes at the top of each corner to facilitate handling.

- B. WALLS. Each wall shall be one single monolithic piece with faux brick textured appearance. Panelized construction is not allowed.
- C. CONNECTIONS. Wall panels shall overlap to form a permanent weather-proof connection with a seamless exterior appearance that uses low-maintenance silicone caulk matching the shelter's exterior color. Internal connections shall use stainless steel hardware spaced no more than 12" on center.
- D. EXTERIOR. All exterior surfaces shall have 18-20 mils of superior performance marine grade gel coat, incorporating ultra-violet inhibitors. Exterior color shall be storm gray.
- E. INTERIOR. All interior surfaces shall be sprayed with 18-20 mils of Polycor 944 high quality isophthalic white gel coat finish offering the same characteristics as the exterior surfaces without ultra-violet inhibitors. Interior surface shall not contain any visible surface-mounted strut or other unsightly channel.
- F. SKID FRAME.
 - 1. Steel frame in accordance with Section 05 50 50 – Metal Fabrications
 - 2. Provide (4) welded lifting eyes located at each corner of the skid
 - 3. Provide 4-inch thick (R-24) rigid polyisocyanurate foam between each cross member
 - a. Exposed insulation faces shall be coated to protect against physical abuse, UV exposure and water intrusion in service. The coating shall be suitable for direct application over insulation with no deleterious effects to the insulation or coating. The coating shall be formulated for long-term service and retained flexibility over extended periods of exposure to sunlight, harsh weather, and saltwater spray. The strength of the adhesive bond of the coating to the insulation shall be greater than the tensile strength of the coating. In the event the coating is nicked or an edge is rolled up in handling, the coating that has been dislodged shall tear free from the coating still adhering to the insulation rather than pull the balance of the coating off as a sheet.
 - b. The coating shall be applied and cured in strict accordance with the manufacturer's recommendations and good commercial practice such that the finished product is free of defects affecting its intended purpose.
 - c. The coating color shall be black.
 - d. The coating shall be SWD Urethane Quik-Shield 951, or approved equal.
- G. DIAMOND PLATE walking surface, 1/8" thick, one 6" diameter hole located between two cross members, powder coated gray, screwed to base frame.
- H. SIKAFLEX-15LM caulk for weather-tight connection between FRP shelter mounting flange and metal base.
- I. ACCESS
 - 1. ROOF HATCH, 36"x36" with removable FRP lid and at least one lifting eye. Color matches shelter roof.
 - 2. Pedestrian doors shall be made of fiberglass reinforced polymer (FRP) using exclusive FiberWrap technology to eliminate the possibility of delamination during the shelter's entire lifespan.

3. Pedestrian doors shall be hung with stainless steel ball bearing type hinges equipped with tamper-resistant, non-removable pins. Hinges shall be oriented with no fasteners exposed when door is closed.
4. Pedestrian doors shall be sealed with a weather-tight EPDM gasket along the entire perimeter of the door.
5. Pedestrian doors shall have a 2.5" deep aluminum rain drip molding located above.
6. All pedestrian doors must be able to be set in 'open' position with no hands. Doors must be able to be removed from 'open' position and closed with no hands. Doors must have hydraulic closer to prevent wind damage to door.
7. (1) 3'-0" wide x 6'-8" high single door(s).
 - a. Closure system is corrosion resistant stainless steel 3-point, pad-lockable.
 - b. Threshold is raised step-over FRP (<3" high).
- J. PENETRATION. (1) rectangular area where the end-user can cut through wall or ceiling without exposing the core foam material thereby guaranteeing a weatherproof penetration for the life of the structure. Locations must not be visible from outside the shelter.
- K. ELECTRICAL – in accordance with drawings.
- L. ILLUMINATION - in accordance with drawings.
- M. HVAC - in accordance with drawings.

2.4 MATERIALS

- A. Walls, roof and doors shall be seamless, one-piece panels laminated with 1/8" thick sprayed fiberglass outside surface, core material, and 1/8" thick sprayed fiberglass inside surface. Walls, roof and doors shall have continuous FiberBeam laminations (floor to ceiling and top-of-wall to ridge) every 12" to permanently bond inner FRP surface with outer FRP surface to provide structural integrity and prevent de-lamination of the fiberglass from the core material.
- B. Walls and floor shall have minimum R-30 insulation with core consisting of minimum 4.5" thick foam.
- C. Roof shall have minimum R-40 insulation with core consisting of minimum 6" thick foam.
- D. Minimum 19/32" thick wood encapsulated within interior surface of all walls for mounting equipment.

PART 3 - EXECUTION

3.1 PREPARATION.

- A. Install foundation true and level to a maximum surface variance of 3/16" where the shelter interfaces with the foundation.
- B. The gravel pad below and immediately surrounding the shelter perimeter shall be sloped away at a pitch of 1/2" per foot to promote proper drainage and eliminate the potential of standing water around the shelter.

3.2 ERECTION

- A. Follow written offloading and installation instructions provided by shelter manufacturer.
- B. Install and make final electrical connections to all equipment shipped loose with water-tight flexible conduit and fittings.

END OF SECTION

DIVISION 22 PLUMBING

SECTION 22 05 00**COMMON WORK RESULTS FOR PLUMBING****PART 1 - GENERAL****1.1 SCOPE**

- A. All provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to this work.

1.2 WORK INCLUDED

- A. The work to be included in these and all other mechanical subsections shall consist of providing, installing, adjusting and setting into proper operation, complete and workable systems for all items shown on the drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.
- B. Division 01 of the specifications is to be specifically included as well as all related drawings.

1.3 RELATED WORK

- A. Related Work Specified Elsewhere:
 - 1. Electrical Specifications: Division 26
 - 2. Motors and Connections: Division 26
 - 3. Starters and Disconnects: Division 26
- B. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all mechanical equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, damper motors, electric-pneumatic and pneumatic electric switches, electrical components, wiring and any other miscellaneous Division 22 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical plans.
- C. Carefully coordinate all work with the electrical work shown and specified elsewhere.

1.4 REFERENCED CODES - LATEST ADOPTED EDITION

- | | | |
|----|---------|-----------------------------------|
| A. | NFPA 13 | Installation of Sprinkler Systems |
| B. | NFPA 70 | National Electrical Code (NEC) |
| C. | IMC | International Mechanical Code |
| D. | UPC | Uniform Plumbing Code |
| E. | IFC | International Fire Code |
| F. | IFGC | International Fuel Gas Code |
| G. | IBC | International Building Code |

1.5 SUBMITTALS

- A. See General Conditions and the General Requirements in Division 01 regarding submittals.
- B. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be in booklet form. The data shall be arranged and indexed under basic categories. A typewritten index shall be included with dividers and identifying tabs between sections and references to sections of specifications.
- C. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alaska standard and as amended by the local Authority Having Jurisdiction.
- B. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be “lead free” in accordance with the Safe Drinking Water Act, Section 1417. “Lead free” materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not 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. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61, or NSF-61G.

1.7 PROJECT RECORD DRAWINGS

- A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building.
- B. Show the location of all valves and their appropriate tag identification.
- C. At completion of project, deliver these drawings to the owner and obtain a written receipt.

1.8 HANDLING

- A. See General Conditions and the General Requirements in Division 01 regarding material handling.
- B. Deliver packaged materials to job site in unbroken packages with manufacturer's label, and store to facilitate inspection and installation sequence. All items must be labeled and identified as to make, size and quality.

1.9 SUBSTITUTIONS

- A. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment. The owner shall be the final authority regarding acceptability of substitutes.

1.10 DIMENSIONS

- A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.
- B. Any differences, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

1.11 MANUFACTURER'S DIRECTIONS

- A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise in the plans. Advise the owner of any such conflicts before installation.

1.12 PERMITS, FEES, ETC

- A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.13 TESTING

- A. The Contractor under each section shall, at his own expenses, perform the various tests as specified and required by the owner and as required by applicable code, the State, and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests.

1.14 TERMINOLOGY

- A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.
- B. Where a material is described in detail, listed by catalog number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.
- C. The use of the word "shall" conveys a mandatory condition to the contract.
- D. "This section" refers to the section in which the statement occurs.
- E. "The project" includes all work in progress during the construction period.
- F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

1.15 SCHEDULE OF WORK

- A. The work must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade. The owner will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process his work so as to ensure the proper execution of it.

1.16 COOPERATION AND CLEANING UP

- A. The contractor for the work under each section of the specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole,

the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

- B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the owner, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

1.17 GUARANTEE

- A. Unless a longer guarantee is hereinafter called for, all work, materials and equipment items shall be guaranteed for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Owner, shall be repaired and/or replaced to the complete satisfaction of the Owner. Guarantee shall be in accordance with Division 01.

1.18 COMPLETION REQUIREMENTS

- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
 - 1. Accurate project record drawings, shown in red ink on a clean set of 11x17 prints or electronic PDF format, showing all changes from the original plans made during installation of the work.
 - 2. All manufacturers' guarantees.
 - 3. Warranties.
 - 4. Operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.
- B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

2.2 RESTRICTED MATERIALS

- A. No materials containing asbestos in any form shall be allowed. Where materials or equipment provided by this Contractor are found to contain asbestos, such items shall be removed and replaced with non-asbestos items. Entire cost of asbestos removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those asbestos containing items installed by the Contractor.
- B. No solder or flux containing lead shall be used on this project.

PART 3 - EXECUTION

3.1 DRAWINGS

- A. The mechanical drawings are generally diagrammatic. Complete details of the building, which affect the mechanical installation, may not be shown. For additional details, see Architectural and Electrical Drawings. Coordinate work under this section with that of all related trades.

3.2 INSTALLATION

- A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the NFPA, IMC, IFC, UPC, IFGC and IBC Standards; all local and state amendments to all codes and standards.
- B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.
- C. Compliance with codes and ordinances shall be at the Contractor's expense.

3.3 MEASUREMENTS

- A. Verify all measurements on the job site.
- B. Locate all equipment and fixtures on the centers of walls, openings, spaces, etc., unless specified otherwise.
- C. Check all piping, ducts, etc. to clear openings.
- D. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with ADA Guidelines.

3.4 OPERATING INSTRUCTIONS

- A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all systems and equipment under the jurisdiction of the Mechanical Division. These instructions shall also be included in a written summary in the Operating Maintenance Manuals.
- B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of four hours of onsite instruction to the owner designated personnel.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. Submit maintenance manuals to the Engineer covering all equipment, fixtures, devices, etc. installed by the Contractor. Submittals to Engineer shall be in bookmarked PDF format. Submit prior to substantial completion.
- B. The final operation and maintenance manuals provided to owner shall be bound in a loose leaf three ring binder with reinforced holes in the sheets so as to prevent lost pages. The manual shall contain, but not limited to, the following types of information:
 - 1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
 - 2. Catalog cuts of all equipment, fixtures, etc. installed (Marked to identify the specific items used).
 - 3. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
 - 4. Identification numbers of all parts and nearest sources for obtaining parts and services.
 - 5. Reduced scale drawings of the control system and a verbal description of how these controls operate.
 - 6. A copy of valve schedule and reduced scale drawings showing valve locations.
 - 7. Written summary of instructions to Owner.
- C. A periodic maintenance form that includes all of the equipment shall be provided with the maintenance manual. The form shall list each piece of equipment and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done.

3.6 CUTTING, FITTING, PATCHING AND FINISH

- A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where it is necessary to disturb such work to permit installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.

- B. Avoid cutting, insofar as possible, by setting sleeves, frames, etc. and by requesting openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for piping.
- C. Cut all holes neatly and as small as possible to admit work. Include cutting where sleeves or openings have been omitted. Perform cutting in a manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

3.7 PAINTING

- A. Perform all of the following painting in accordance with manufacturer recommendations. Provide the following items as a part of mechanical work:
 - 1. Factory applied prime and finish coats on mechanical equipment.
 - 2. Pipe identification where specified.
- B. If factory finish on any equipment furnished is damaged in shipment or during construction, refinish to equal original factory finish.

3.8 INSTALLATION OF EQUIPMENT

- A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.
- B. Maintain manufacture recommended minimum clearances for access and maintenance.
- C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.
- D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.
- E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all apparatus furnished under this Contract.

END OF SECTION

SECTION 22 05 03
PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Pipe and pipe fittings for the following systems:
1. Domestic water piping.
 - 2.
 3. Equipment drains and over flows.
 4. Unions and flanges.
- B. Applicability: This specification section applies only to water side piping within 20 ft of a heat exchanger. For other water side piping, refer to Division 40.
- C. Related Sections:
1. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
 2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers, supports, and firestopping for placement by this section.
 3. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product requirements for vibration isolation for placement by this section.
 4. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
 2. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 3. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 4. ASME B31.9 - Building Services Piping.
 5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. ASTM International:
1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM B32 - Standard Specification for Solder Metal.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
5. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
6. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
7. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
8. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot-and Cold-Water Distribution Systems.
9. ASTM F2080 – Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

1.3 SUBMITTALS

- A. Division 01- Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.
- C. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. Perform Work in accordance with State of Alaska standards and as amended by the local Authority Having Jurisdiction.
- C. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be "lead free" in accordance with the Safe Drinking Water Act, Section 1417. "Lead free" materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not 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. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61, NSF-61G, NSF 372 or NSF 14.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum three years' experience.
- C. Design piping systems under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Alaska.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. PVC Pipe:

1. Schedule 80 PVC: conforming to ASTM D1784 and ASTM D1875 with titanium dioxide for ultraviolet protection. Solvent Welded, Threaded, or Flanged connections.
2. Fittings: Schedule to match pipe. ASTM D2466 or D2467 for socket weld. ASTM D2464 for threaded. Solvent weld except where connection to threaded or flanged valves and equipment may require future disassembly. Threaded female joints shall be metal reinforced, with Teflon tape thread lubricant.
 1. Flanges: One-piece, molded hub type PVC flat flange in accordance with fittings above. ASME B16.1, Class 125 drilling.
 - a. Bolting: Flat face mating flanges ASTM A193/A193M, Type 316 stainless steel grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads.
 - b. Gaskets: Full faced 1/8-inch thick ethylene propylene (EPR) rubber.
3. Solvent Cement: ASTM D2564 and ASTM F656 primer, chemically resistant to fluid service. Solvent cement and primer shall be listed by NSF 61 for contact with potable water.

B. Copper Tubing: ASTM B88, Type L, annealed.

1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53 Schedule 40, galvanized.

1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
2. Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type L, drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.
- C. ABS Pipe: ASTM D2680, Acrylonitrile-Butadiene-Styrene (ABS) material.
1. Fittings: ABS, ASTM D2680
 2. Joints: ASTM D2235, solvent weld.

2.4 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
1. Copper Piping: Class 150, bronze unions with soldered or brazed joints.
 2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- B. Flanges for Pipe 2-1/2 inches and Larger:
1. Copper Piping: Class 150, slip-on bronze flanges.
 2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify excavations are to required grade, dry, and not over-excavated.
- C. Verify trenches are ready to receive piping.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - ABOVE GROUND PIPING

- A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- G. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- H. Slope piping and arrange systems to drain at low points.
- I. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- J. Install valves in accordance with Section 22 05 23.
- K. Install piping specialties in accordance with Section 22 11 00.
- L. Insulate piping. Refer to Section 22 07 00.
- M. Install pipe identification in accordance with Section 22 05 53.

3.4 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

- A. Install domestic water piping system in accordance with Section 22 11 00.

3.5 FIELD QUALITY CONTROL

- A. Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

- B. Test domestic water piping system in accordance with applicable code and as amended by the local authority having jurisdiction.
- C. Test sanitary waste and vent piping system in accordance with applicable code and as amended by the local authority having jurisdiction.

3.6 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean and disinfect domestic water distribution system in accordance with Division 33.

END OF SECTION

SECTION 22 05 23 GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Butterfly valves.
3. Check valves.

B. Applicability: This specification section applies only to water side piping within 20 ft of a heat exchanger. For other water side piping, refer to Division 40.

C. Related Sections:

1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.
3. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.

1.2 REFERENCES

A. ASTM International:

1. ASTM F441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
2. ASTM D4101 – Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 67 - Butterfly Valves.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Underwriters Laboratories Inc.:

1. UL 842 – Valves for Flammable Fluids.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals
- B. Product Data: Submit manufacturers 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.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves.
- C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. Perform Work in accordance with State of Alaska standard and as amended by the local Authority Having Jurisdiction.

1.6 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' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product 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.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

1.10 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.

PART 2 - PRODUCTS

2.1 BALL VALVES

- A. Manufacturers:
 - 1. Conbraco Industries, Inc.
 - 2. Apollo Valves.
 - 3. Hammond Valve.
 - 4. Milwaukee Valve Company.
 - 5. NIBCO INC.
 - 6. Substitutions: Division 01 - Product Requirements.
- B. 2 inches and Smaller: MSS SP 110, bronze, two piece body, chrome plated ball, full port, teflon seats, blow-out proof stem, PEX Expansion, solder, or threaded ends with union and lever handle. NSF 61 certified.
- C. Over 2 Inches: Cast steel, two piece body, full port chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged. Seat material to be compatible with liquid handled. NSF 61 certified.

2.2 BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Conbraco Industries, Inc.
 - 2. Apollo Valves.
 - 3. Hammond Valve.
 - 4. Milwaukee Valve Company.
 - 5. NIBCO INC.
 - 6. Substitutions: Division 01 - Product Requirements.

B. 2-1/2 inches and Larger: MSS SP 67

1. Body: Cast or ductile iron, wafer or lug ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze
3. Seat: Resilient replaceable seat suitable for service.
4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.
5. NSF 61 certified.

2.3 CHECK VALVES**A. Horizontal Swing Check Valves:**

1. Manufacturers:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Substitutions: Division 01 - Product Requirements.
2. Up to 2 Inches: Bronze swing disc, solder or screwed ends. NSF 61 certified.
3. Over 2 Inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends. NSF 61 certified.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. 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.

- D. Install valves with clearance for installation of insulation and allowing access.
- E. Provide access where valves and fittings are not accessible.
- F. Refer to Section 22 05 29 for pipe hangers.
- G. Refer to Section 22 07 00 for insulation requirements for valves.
- H. Refer to Section 22 05 03 for piping materials applying to various system types.

3.3 VALVE APPLICATIONS

- A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- B. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball or butterfly valves for throttling, bypass, or manual flow control services.
- D. Install spring loaded check valves on discharge of water pumps.
- E. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- F. Install ball and butterfly valves in domestic water systems for shut-off service.
- G. Install ball and butterfly valves in domestic water systems for throttling service.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Formed steel channel.
7. Firestopping relating to plumbing work.
8. Firestopping accessories.

B. Applicability: This specification section applies only to water side piping within 20 ft of a heat exchanger. For other water side piping, refer to Division 40.

C. Related Sections:

1. Division 07 - Joint Protection: Product requirements for sealant materials for placement by this section.
2. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
4. Section 22 11 00 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
5. Section 22 13 00 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
4. 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 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.
3. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
4. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods and calculations sealed by a registered

professional engineer.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.
- B. Perform Work in accordance with State of Alaska standards and as amended by the local Authority Having Jurisdiction.
- C. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS**2.1 PIPE HANGERS AND SUPPORTS**

A. Manufacturers:

1. Michigan Hanger Company.
2. B-Line Systems, Inc.
3. Substitutions: Division 01 - Product Requirements.

B. Plumbing Piping - Water:

1. Conform to MSS SP58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Vertical Support: Steel riser clamp.
7. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.
- D. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.4 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.

2.5 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Division 01- Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

- A. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- B. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME 31.9, ASTM F708, and MSS SP 89.
- 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. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.

- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports.
- L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.6 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.

3.7 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. Install chrome plated steel escutcheons at finished surfaces.

3.8 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements: Requirements for inspecting, testing.

3.9 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

3.10 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.11 SCHEDULES

PIPE HANGER AND SUPPORT SPACING		
PIPE MATERIAL	MAXIMUM HORIZONTAL HANGER SPACING (Feet)	MAXIMUM VERTICAL SUPPORT SPACING (Feet)
Copper (1-1/2" or less)	6	10
Copper (over 1-1/2")	10	10
PVC, ABS	4	Every Floor and Mid- Level Guide

PIPE HANGER ROD DIAMETER	
PIPE AND TUBE SIZE (Inches)	ROD SIZE (Inches)
1/2" – 4"	3/8"
5" – 8"	1/2"
10" – 12"	5/8"

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Labels.

B. Related Sections:

1. Section 22 05 03 - Pipes and tubes for plumbing piping.
2. Section 22 05 23 – General-duty valves for plumbing piping.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Division 01 - 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.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two containers of spray-on adhesive.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Manufacturers:
 - 1. Brady ID
 - 2. Seton Identification Products.
 - 3. Substitutions: Division 01 - Product Requirements.
- B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

- A. Plastic Tags:
 - 1. Manufacturers:
 - a. Brady ID
 - b. Seton Identification Products.
 - c. Substitutions: Division 01 - Product Requirements.
 - 2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter or square.
- B. Metal Tags:
 - 1. Manufacturers:

- a. Brady ID
 - b. Seton Identification Products.
 - c. Substitutions: Division 01 - Product Requirements.
2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter or square with finished edges.

2.3 STENCILS

- A. Manufacturers:
 1. Seton Identification Products.
 2. Substitutions: Division 01 - Product Requirements.
- B. 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. Ductwork and Equipment: 1-3/4 inches high letters.
- C. Stencil Paint: Semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 1. Manufacturers:
 - a. Brady ID
 - b. Seton Identification Products.
 - c. Substitutions: Division 01 - Product Requirements.
 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:
 - a. Brady ID
 - b. Pipemarker.com; Brimar Industries, Inc.
 - c. Seton Identification Products.
 - d. Substitutions: Division 01 - Product Requirements.
 2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with manufacturer's recommendations for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with manufacturer's recommendations.
- 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. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Identify tanks, expansion tanks, and heat exchangers with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify pumps and valves in main and branch piping with tags.
- I. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers, or stenciled painting. 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.

END OF SECTION

**SECTION 22 07 00
PLUMBING INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Applicability: This specification section applies only to water side piping within 20 ft of a heat exchanger. For other water side piping, refer to Division 40.

C. Related Sections:

1. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers, supports, and firestopping for placement by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
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 D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
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.

1.3 SUBMITTALS

- A. Division 01 - 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.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Perform Work in accordance with State of Alaska standards and as amended by the local Authority Having Jurisdiction.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

- B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - 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 damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - 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.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Certain-Teed.
- B. Johns Manville.
- C. Knauf.
- D. Owens-Corning.

- E. Armacell
- F. Substitutions: Division 01 - Product Requirements.

2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 850 degrees 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 degrees F.
- B. TYPE P-2: ASTM C518, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
 - 1. ASTM C921 white Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Water Vapor Permeance: ASTM E96; 0.02 perms.
- B. Aluminum Pipe Jacket:
 - 1. ASTM B209.
 - 2. Thickness: 0.020 inch thick sheet.
 - 3. Finish: Corrugated or textured.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
- C. PVC Plastic Pipe Jacket:
 - 1. Product Description: ASTM D1785 One piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 10 mil.
 - 3. Connections: Pressure sensitive color matching vinyl tape.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- 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: ASTM C449.

- D. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- E. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping and equipment has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 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. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- C. Glass Fiber Board Insulation:
 - 1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 - 2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
 - 3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- 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: Compression resistant insulating material suitable for planned temperature range and service.

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.

3.3 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Potable water	P-1 or P-2	All sizes	1.0
Raw water	P-1 or P-2	All Sizes	1.0

END OF SECTION

SECTION 22 11 00 FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pressure gages.
2. Pressure gage taps.
3. Thermometer.
4. Relief valves.
5. Strainers.

- B. Applicability:** This specification section applies only to water side piping within 20 ft of a heat exchanger. For other water side piping, refer to Division 40.

C. Related Sections:

1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
2. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
3. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers, supports, and firestopping for placement by this section.
4. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
5. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
6. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
6. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).
7. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

D. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395 - 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 B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
10. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
11. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.
12. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
13. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
14. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
15. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

16. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
17. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
18. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
19. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
20. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
21. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
22. ASTM E1 - Standard Specification for ASTM Thermometers.
23. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
24. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
25. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
26. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
27. ASTM F441 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
28. ASTM F442 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
29. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
30. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
31. ASTM F 891 - Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.
32. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
33. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
34. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.

4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
6. AWWA C651 - Disinfecting Water Mains.
7. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
8. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
9. AWWA C702 - Cold-Water Meters - Compound Type.
10. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
11. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
12. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
13. AWWA C950 - Fiberglass Pressure Pipe.
14. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. 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 80 - Bronze Gate, Globe, Angle and Check Valves.
4. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
5. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

I. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. 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.
4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

- C. Manufacturer's Installation Instructions: Submit installation instructions for valves and accessories.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves and equipment.
- C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be “lead free” in accordance with the Safe Drinking Water Act, Section 1417. “Lead free” materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not 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. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61, NSF-61G, NSF 372 or NSF 14.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.

- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- A. Manufacturers:

- 1. Hayward Flow Control; a division of Hayward Industries, Inc.
- 2. Watts; a Watts Water Technologies Company.
- 3. Zurn Industries, LLC.
- 4. Cole-Parmer.
- 5. Substitutions: Division 01 - Product Requirements.

- B. Gauge: ASME B40.1, UL 393 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

- 1. Case: ABS.
- 2. Bourdon Tube: Phosphor bronze.
- 3. Dial Size: 3-1/2 inch diameter.
- 4. Mid-Scale Accuracy: One percent.

5. Scale: 0-100 PSI.

2.2 PRESSURE GAUGE TAPS

A. Manufacturers:

1. Hayward Flow Control; a division of Hayward Industries, Inc.
2. Substitutions: Division 01 - Product Requirements.

B. Ball Valve: Brass, 1/8 inch NPT for 250 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Terice
2. Weiss Instruments, Inc.
3. Substitutions: Division 01 - Product Requirements.

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long
4. Accuracy: 2 percent.
5. Calibration: Degrees F.
6. Scale: 0-200 Degrees F.

2.4 RELIEF VALVES

A. Manufacturers:

1. Watts; a Watts Water Technologies Company.
2. Zurn Industries, LLC.
3. Substitutions: Division 01 - Product Requirements.

B. Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

C. Temperature and Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.5 STRAINERS

A. Manufacturers:

1. NIBCO INC.
2. Zurn Industries, LLC.
3. Substitutions: Division 01 - Product Requirements.

B. Size 2 inch and Smaller: Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 1-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - THERMOMETERS AND GAGES

A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.

B. Install gage taps in piping.

- C. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to known pressure/temperature.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- D. Group piping whenever practical at common elevations.
- E. Slope piping and arrange systems to drain at low points.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- H. Provide access where valves and fittings are not accessible.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.
- L. Install domestic water piping in accordance with ASME B31.9.

- M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
- N. Install unions downstream of valves and at equipment or apparatus connections.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- Q. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- R. Install ball or butterfly valves for throttling, bypass, or manual flow control services.
- S. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- T.
- U. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

3.5 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements and 01- Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test domestic water piping system in accordance with applicable code and as amended by the local authority having jurisdiction.

3.6 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Disinfect water distribution system in accordance with Division 33.

END OF SECTION

SECTION 22 35 00
DOMESTIC WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic water heat exchangers.

B. Related Sections:

1. Section: 22 11 00 - Facility Water Distribution: Supply connections to domestic water heaters.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME PTC 25 - Pressure Relief Devices.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.

C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity and power requirements.

D. Manufacturer's Installation Instructions: Submit mounting and support requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.5 QUALITY ASSURANCE

- A. Conform to ASME for construction of heat exchangers.
- B. Perform Work in accordance with State of Alaska standard and as amended by the local Authority Having Jurisdiction.
- C. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be "lead free" in accordance with the Safe Drinking Water Act, Section 1417. "Lead free" materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not 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. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61, NSF-61G, NSF 372 or NSF 14.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Products storage and handling requirements.
- B. Protect heat exchangers and tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for heat exchangers.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER HEAT EXCHANGERS

- A. Manufacturers:
 - 1. Kelvion.
 - 2. Taco, Inc.
 - 3. Substitutions: Division 01 - Product Requirements.
- B. Construction: Braze alloy to be copper 99.9% and connector to be 304 stainless steel.
- C. Plates: Double wall, Stainless steel Type 316L.
- D. Maximum allowable working pressure rating 650 psig and temperature rating 350°F.
- E. NSF 61 approved.
- F. Heat Exchanger Performance: See schedule on drawings.
- G. Accessories:
 - 1. Thermometers and pressure gauge taps on water inlets and outlets.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the following piping accessories.
 - 1. On supply:
 - a. Thermometer well and thermometer.
 - b. Strainer.
 - c. Pressure gage.
 - d. Shutoff valve.
 - 2. On return:

- a. Thermometer well and thermometer.
 - b. Pressure gage.
 - c. Shutoff valve.
- B. Install discharge piping from relief valves and drain valves to nearest floor drain.

END OF SECTION

DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be in booklet or electronic form.
 - 1. Booklet Form: The data shall be arranged and indexed under basic categories. A typewritten index shall be included with dividers and identifying tabs between sections and references to sections of specifications.
 - 2. Electronic Form: The data shall be provided in PDF format. The data shall be arranged and indexed under basic categories. All data must be bookmarked by section and clearly marked.
- B. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.
- C. Only submit on items specifically required by each specification section. If a submittal has not been requested, it will be returned to the Contractor and will not be reviewed.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alaska standards and as amended by the local authority having jurisdiction.
- B. Perform work with skilled craftsman specializing in said work. Install all materials in a neat, orderly, and secure fashion as required by specifications and commonly recognized standards of good workmanship.

1.3 SUBSTITUTIONS

- A. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment.
- B. The owner shall be the final authority on acceptability of substitutions.

1.4 DIMENSIONS

- A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.
- B. Any differences, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

1.5 MANUFACTURER'S DIRECTIONS

- A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise in the plans. Advise the owner of any such conflicts before installation.

1.6 PERMITS, FEES, ETC.

- A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.7 TESTING

- A. The Contractor under each section shall, at his own expenses, perform the various tests as specified and required by the owner and as required by applicable code, the State, and local authorities.
- B. The Contractor shall furnish all fuel and materials necessary for making tests.

1.8 TERMINOLOGY

- A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.
- B. Where a material is described in detail, listed by catalog number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.
- C. The use of the word "shall" conveys a mandatory condition to the contract.
- D. "This section" refers to the section in which the statement occurs.

- E. "The project" includes all work in progress during the construction period.
- F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

1.9 SCHEDULE OF WORK

- A. The work must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade.
- B. The owner will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process his work so as to ensure the proper execution of it.

1.10 COOPERATION AND CLEANING UP

- A. The contractor for the work under each section of the specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the owner, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

1.11 WARRANTY

- A. Warranty shall be in accordance with Division 01.
- B. Unless a longer warranty is called for within project specifications, all work, materials and equipment items shall be guaranteed for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Architect or Engineer, shall be repaired and/or replaced to the complete satisfaction of the Architect/Engineer.

1.12 COMPLETION REQUIREMENTS

- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:

- B. Accurate project record drawings showing all changes from the original plans made during installation of the work.
- C. All manufacturers' guarantees.
- D. Warranties.
- E. Operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide all equipment and materials required for a complete system.
- B. All equipment and materials supplied under this Contract are new unless specifically indicated as existing. Where additional or replacement items are required, provide like items by the same manufacturer to the maximum extent practical.
- C. Install all material and equipment in accordance with manufacturer's installation instructions and recommendations unless specifically indicated.

2.2 ELECTRICAL MOTORS

- A. Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than + 10% of rated voltage. Motors for pumps and fans shall be selected to be non-overloading.
- B. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.
- C. Size motors for 1.15 service factor.
- D. Fractional horsepower motors to have self-resetting thermal overload switch.
- E. Provide Premium Efficiency, motors for all three phase motors one horsepower and larger. Standard efficiency motors will not be acceptable.

2.3 RESTRICTED MATERIALS

- A. No materials containing asbestos in any form shall be allowed.

- B. No solder or flux containing lead shall be used on this project.

PART 3 - EXECUTION

3.1 DRAWINGS

- A. The mechanical drawings are generally diagrammatic and do not necessarily show all features of the required work. Complete details of the building, which affect the mechanical installation, may not be shown. For additional details, see Architectural, and Electrical Drawings. Coordinate work under this section with that of all related trades.
- B. Contractor to field verify all dimensions and conditions prior to start of construction. Immediately contact the Engineer for clarification of questionable items or apparent conflicts.

3.2 INSTALLATION

- A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the NFPA, IMC, IFC, UPC, IFGC and IBC Standards; all local and state amendments to all codes and standards.
- B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.
- C. Compliance with codes and ordinances shall be at the Contractor's expense.

3.3 MEASUREMENTS

- A. Verify all measurements on the job site.
- B. Check all piping, ducts, etc. to clear openings.
- C. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with ADA Guidelines.

3.4 OPERATING INSTRUCTIONS

- A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all mechanical systems and equipment.
- B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of four hours of onsite instruction to the owner designated personnel.

3.5 OPERATING AND MAINTENANCE MANUALS

- A. Submit maintenance manuals to the Engineer covering all equipment, fixtures, devices, etc. installed by the Contractor. Submit prior to substantial completion. A separate chapter is required for each section of the specifications with subchapters for each class of equipment or system.
- B. The operation and maintenance manuals shall be bound in a loose leaf three ring binder with reinforced holes in the sheets so as to prevent lost pages. The manual shall contain, but are not limited to, the following types of information:
 - 1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
 - 2. A table of contents for each chapter listing each major item with a page or mark number. Each page of the manual is to be numbered.
 - 3. Catalog cuts of all equipment, fixtures, etc. installed (Marked to identify the specific items used). Equipment identification is to be the same as shown on nameplates, i.e. B-1, BP-1, etc.
 - 4. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
 - 5. Manufacturer's required spare parts list for all equipment with replaceable parts.
 - 6. Identification numbers of all parts and nearest sources for obtaining parts and services.
 - 7. Reduced scale drawings of the control system and a verbal description of how these controls operate.
 - 8. A copy of the final test and balance report.
 - 9. A copy of valve schedule and reduced scale drawings showing valve locations.
- C. Operating Sequence Narrative: To be typewritten and in outline form. In each chapter, describe procedures necessary to operate equipment covered by chapter. Include procedures for start-up, shut down, and emergency operation. Provide a description of all adjustments necessary or optional.
- D. Maintenance Instructions: In each chapter describe maintenance procedures for equipment covered by the chapter. Include manufacturer's recommended preventive/periodic maintenance form that includes all of the equipment provided with the maintenance manual. This shall be a standalone document, which can be used independent of the rest of the operations and maintenance manual. The form shall list each piece of equipment and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done. Maintenance instructions shall include instructions for minor repairs that could be reasonably performed by persons qualified to operate the equipment and perform day-to-day maintenance.
- E. Include instruction in the use of the completed and approved Operations and Maintenance Manual as part of the required training for Owner Personnel.

END OF SECTION

SECTION 23 05 03**PIPES AND TUBES FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 SUMMARY**

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Heating water piping.
2. Glycol piping.
3. Equipment drains and over flows.
4. Fuel oil piping.
5. Unions and flanges.

B. Related Sections:

1. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
2. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 23 05 23 - General-Duty Valves for HVAC Piping: Product requirements for valves for placement by this section.
4. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers, and supports for placement by this section.
5. Section 23 07 00 - HVAC Insulation: Product requirements for piping insulation for placement by this section.
6. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.

1.2 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 B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
6. ASME B31.9 - Building Services Piping.
7. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

8. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395 - 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 B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.
7. ASTM B75 - Standard Specification for Seamless Copper Tube.
8. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
9. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
10. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
11. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
12. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
13. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot-and Cold-Water Distribution Systems.
14. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
15. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot-and Cold-Water Distribution Systems.
16. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:

1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

E. National Fire Protection Association:

1. NFPA 30 - Flammable and Combustible Liquids Code.
2. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
3. NFPA 54 - National Fuel Gas Code.
4. NFPA 58 - Liquefied Petroleum Gas Code.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.
- C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.
- D. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. Perform Work in accordance with State of Alaska standards and as amended by the local authority having jurisdiction.
- C. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum years' experience.
- C. Design pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Alaska.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.
- B. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.1 HEATING GLYCOL PIPING, ABOVE GROUND

- A. Copper Tubing: ASTM B88, Type L drawn.
 - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
 - 2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 - 3. Joints: ASTM B32, AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.
- B. Steel Pipe: ASTM A53 Schedule 40, galvanized.
 - 1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
 - 2. Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

C. Copper Tubing: ASTM B88, Type L, drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

2.2 FUEL OIL PIPING - ABOVE GROUND

A. Steel Pipe: ASTM A53 or ASME B36.10M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234 wrought carbon steel and alloy steel welding type.
2. Joints: Threaded for pipe indoor connection; welded for pipe outdoor connections.

2.3 UNIONS AND FLANGES

A. Unions:

1. Ferrous Piping: Class 150, malleable iron, threaded.

B. Flanges:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

- A. Ream metal pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - ABOVE GROUND PIPING

- A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 00.
- G. Provide access where valves and fittings are not accessible.
- H. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- I. Slope piping and arrange systems to drain at low points.
- J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- K. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- L. Install valves in accordance with Section 23 05 23.
- M. Install hydronic piping specialties in accordance with Section 23 21 16.
- N. Insulate piping. Refer to Section 23 07 00.
- O. Install pipe identification in accordance with Section 23 05 53.

3.4 INSTALLATION - ABOVEGROUND FUEL OIL PIPING

- A. Install fuel oil piping in accordance with NFPA 31.
- B. Install fuel oil piping in accordance with Section 23 10 00.
- C. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install in accordance with NACE RP-01-69.

3.5 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Hydrostatically test glycol piping system in accordance with ASME B31.1 and the International Mechanical Code.
- C. Pressure test fuel oil piping in accordance with NFPA 31.

3.6 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. After completion, fill, clean, and glycol piping system.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Check valves.

B. Related Sections:

1. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and installation requirements for pipe hangers and supports.
3. Section 23 07 00 - HVAC Insulation: Product and installation requirements for insulation for valves.
4. Section 23 21 16 - Hydronic Piping Specialties: Product and installation requirements for piping specialties used in hydronic piping systems.

1.2 REFERENCES

A. ASTM International:

1. ASTM A216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
2. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

3. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
5. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Underwriters Laboratories Inc.:

1. UL 842 - Valves for Flammable Fluids.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturers 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.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves.
- C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alaska standards and as amended by the local authority having jurisdiction.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product 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.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.10 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.

PART 2 - PRODUCTS**2.1 BALL VALVES**

- A. Manufacturers:
 - 1. Hammond Valve
 - 2. Milwaukee
 - 3. NIBCO
 - 4. FNW
 - 5. Conbraco Industries
 - 6. Substitutions: Division 01 – Product Requirements.
- B. Up to 2 Inches: Class 150, bronze two piece body, full port, forged brass, chrome plated ball, Teflon seats and stuffing box ring, blow-out proof stem, lever handle solder or threaded ends with union. Seat material to be compatible with fluid handled.

- C. Over 2 Inches: Class 150, cast steel, two piece body, full port chrome plated steel ball, Teflon seat and stuffing box seals, lever handle flanged. Seat material to be compatible with liquid handled.

2.2 CHECK VALVES

A. Manufacturers:

1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.
6. Substitutions: Division 01 - Product Requirements.

B. Horizontal Swing Check Valves:

1. Up to 2 Inches: Class 125, bronze swing disc, solder or screwed ends.
2. Over 2 Inches: Class 125, iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. 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.
- D. Install valves with clearance for installation of insulation and allowing access.
- E. Provide access where valves and fittings are not accessible.
- F. Refer to Section 23 05 29 for pipe hangers.
- G. Refer to Section 23 07 00 for insulation requirements for valves.
- H. Refer to Section 23 05 03 for piping materials applying to various system types.

3.3 VALVE APPLICATIONS

- A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball valves for throttling, bypass, or manual flow control services.
- D. Install ball valves in heating water systems for shut-off service.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 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. Firestopping relating to HVAC work.
9. Firestopping accessories.
10. Equipment bases and supports.

B. Related Sections:

1. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
2. Section 23 10 00 - Facility Fuel-Oil System: Execution requirements for placement of hangers and supports specified by this section.

1.2 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 E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
4. 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.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping Materials: ASTM E814 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

1.6 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

- B. Perform Work in accordance with State of Alaska standards and as amended by the local authority having jurisdiction.
- C. Maintain one copy of each document on site.
- D. Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS**2.1 PIPE HANGERS AND SUPPORTS**

- A. Manufacturers:
 - 1. ERICO
 - 2. Globe
 - 3. Hilti
 - 4. NIBCO
 - 5. PHS Industries
 - 6. PHD Manufacturing
 - 7. Substitutions: Division 01 – Product Requirements.
- B. Hydronic Piping:
 - 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 Larger: 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 3 inches and Smaller: Cast iron hooks.
 - 7. Vertical Support: Steel riser clamp.
 - 8. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:

1. ERICO International Corporation
2. National Pipe Hanger Corporation
3. PHS Industries, Inc.
4. Piping Technology & Products, Inc.
5. Value Engineered Products
6. Substitutions: Division 01 – Product Requirements.

2.4 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- D. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 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. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- E. Sealant: refer to Division 07.

2.6 FORMED STEEL CHANNEL

A. Manufacturers:

1. B-Line
2. Unistrut

3. Substitutions: Division 01 – Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Do not drill or cut structural members.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with MSS SP 89.
- 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. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and supports for copper piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.3 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 Division 03.

- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members, formed steel channel, steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.4 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate 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.
- 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.

3.5 FIELD QUALITY CONTROL

- A. Division 01 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

3.6 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

3.7 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.8 SCHEDULES

- A. Pipe Hanger Spacing:

PIPE SUPPORT SPACING

PIPE MATERIAL	MAXIMUM HORIZONTAL SPACING (Feet)	MAXIMUM VERTICAL SPACING (Feet)
Copper Tubing (1-1/4" or less)	6	10
Copper Tubing (over 1-1/4")	10	10
ABS, PVC	4	10 (plus Mid-Level Guide)
CPVC (1" or less)	3	10 (plus Mid-Level Guide)
CPVC (over 1")	4	10 (plus Mid-Level Guide)

PIPE HANGER ROD DIAMETER	
PIPE AND TUBE SIZE (Inches)	ROD SIZE (Inches)
1/2" – 4"	3/8"
5" – 8"	1/2"
10" – 12"	5/8"

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches
3/4	6	3/8
1	6	3/8
1-1/4	6	3/8
1-1/2	10	3/8
2	10	3/8
2-1/2	10	1/2
3	10	1/2
4	12	1/2

END OF SECTION

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Labels.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Division 01 - 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.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS**2.1 NAMEPLATES**

- A. Manufacturers; Nameplates:
 - 1. Seton Identification Products.
 - 2. Substitutions: Division 01 - Product Requirements.
- B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

- A. Plastic Tags:
 - 1. Manufacturers:

- a. Brady ID
 - b. Seton Identification Products.
 - c. Substitutions: Division 01 - Product Requirements.
 2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter or square.
- B. Metal Tags:
 1. Manufacturers:
 - a. Brady ID
 - b. Seton Identification Products.
 - c. Substitutions: Division 01 - Product Requirements.
 2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter or square with finished edges.
- C. Information Tags:
 1. Manufacturers:
 - a. Brady ID
 - b. Seton Identification Products.
 - c. Substitutions: Division 01 - Product Requirements.
 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 plastic laminated.

2.3 STENCILS

- A. Manufacturers:
 1. Seton Identification Products.
 2. Substitutions: Division 01 - Product Requirements.
- B. 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. Ductwork and Equipment: 1-3/4 inches high letters.

- C. Stencil Paint: Semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Manufacturers:
 - a. Brady ID
 - b. Seton Identification Products.
 - c. Substitutions: Division 01 - Product Requirements.
 - 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:
 - a. Brady ID
 - b. Pipemarker.com; Brimar Industries, Inc.
 - c. Seton Identification Products.
 - d. Substitutions: Division 01 - Product Requirements.
 - 2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with manufacturer's recommendations.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with manufacturer's recommendations.
- 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. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Identify air handling units, boilers, unit heaters, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units and radiator valves with numbered tags.
- J. Tag automatic controls, instruments, and relays. Key to control schematic.
- K. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers, or stenciled painting. 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. Identify ductwork with stenciled painting. 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.

END OF SECTION

SECTION 23 05 93**TESTING, ADJUSTING, AND BALANCING FOR HVAC****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Testing adjusting, and balancing of hydronic systems.
 - 2. Measurement of final operating condition of HVAC systems.
- B. Related Documents:
 - 1. Sequence of Operations –Refer to plan set.

1.2 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.
- D. Testing Adjusting and Balancing Bureau:
 - 1. TABB - International Standards for Environmental Systems Balance.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

- C. Test Reports: Indicate data on NEBB Report forms.
- D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms.
- F. Submit draft copies of report for review prior to final acceptance of Project.
- G. As part of as-built project submittal, include a second copy of the system hydronic schematic with the following information. The added content shall be clearly legible in red text and placed on the sheet in a manner that does not obscure other information on the sheet.
 - 1. Label actual flow rates and pressure drops through each balancing valve in red text.
 - 2. Where equipment schedules list specific equipment flow rates, pressure drops, and/or temperature drops, label actual as-built values on corresponding equipment in schematic.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Install tag on each balance valve indicating measured flow rate and valve position.
- C. Install tag on each aquastat and programmable setpoint controller listing temperature setting and differential.
- D. For each variable speed pump and programmable controller provide a paper copy of the manufacturer's field installation/operations manual. In the programming instructional section of the manual, circle or hand-write the settings selected on each page. Hand-writing shall be in red ink and clearly illustrate how to re-program controller to the commissioned settings.
- E. Project Record Documents: Record actual locations of balancing valves and rough setting.
- F. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alaska standard and as amended by the local Authority Having Jurisdiction.
- B. Perform Work in accordance with NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems

- C. Maintain one copy of each document on site.
- D. Prior to commencing Work, calibrate each instrument to be used.

1.6 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years' experience Certified by NEBB.

1.7 SEQUENCING

- A. Division 01 - Summary: Work sequence.
- B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.8 SCHEDULING

- A. Division 01 - Administrative Requirements: Coordination and project conditions.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: 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. HVAC control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Hydronic systems are flushed, filled, and vented.
 - 5. Pumps are rotating correctly.
 - 6. Proper strainer baskets are clean and in place or in normal position.
 - 7. Service and balancing valves are open.

3.2 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

- A. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: 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, make corrections and retake measurements until balance has been verified.
- 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.

3.5 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design quantities.
- B. Confirm air bleeds indicate system is full of water.
- C. Temporarily turn off all pumps, open all zone valves, turn off glycol makeup tank, and allow pressure to equalize through each hydronic and potable water system. Adjust all pressure gauges to ensure the pressure readings are identical within connected piping circuits.
- D. Temporarily isolate boilers from secondary side of the hydronic system, open all zone valves, isolate cold side of heat exchangers, and run secondary circulation pumps until system glycol/water temperature approach room temperature and equalize throughout the system. Synchronize all temperature gauges to read identical temperature readings. Return system to normal operation. Repeat process of removing heating/cooling sources, equalizing temperatures, and synchronizing temperature gauges for boiler system, cold side of heat

exchangers, and other isolated circulation systems with temperature gauges. Return all systems to normal operation after synchronization is complete.

- E. Use calibrated fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices or differential pressure measurements are not available, base flow balance on temperature difference across various heat transfer elements in system.
- F. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with water balancing.
- G. Perform system balance with modulating control valves held at maximum operating position.
- H. Confirm pump rotation, direction of flow, and differential pressure at full flow are in conformance with design requirements and manufacturer's published literature.
- I. Perform adjustment of water/glycol circulation systems by the following measures:
 - 1. Identify the zone with the highest flow loss and fully open its zone valve and balance valve. Close all other zone valves. Set circulation pump(s) to minimum proportional pressure or constant pressure setting that produces adequate flow through this zone.
 - 2. Progressively open zone valves and adjust corresponding balance valves to achieve design flow rates.
 - 3. When all zones are balanced, re-measure flow rates and adjust valve positions as needed to ensure flows are between 100% and 120% of design requirements. The zone with the highest flow resistance shall have its balance valve in the fully open position after all balancing is complete.
 - 4. Open each zone valve individually and measure flow through the zone to verify that pipe maximum velocities are not exceeded when all other zone valves are closed. Maximum velocities are listed below. Notify owner in writing if velocity limits are exceeded.
 - a. Hydronic Heating: 3 feet/second
 - b. Domestic Hot Water: 5 feet/second
 - c. Cold Water: 7 feet/second
- J. Do not use service or shut-off valves for balancing unless designed for both balancing and shut-off functions. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

END OF SECTION

SECTION 23 07 00 HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC piping insulation, jackets and accessories.
2. HVAC equipment insulation, jackets and accessories.

B. Related Sections:

1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers, supports, and firestopping for placement by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
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 C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
18. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
19. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
20. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
21. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
22. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
23. 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.

1.3 SUBMITTALS

- A. Division 01 - 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.

1.4 QUALITY ASSURANCE

- A. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- B. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- C. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

- D. Perform Work in accordance with State of Alaska standard and as amended by the local Authority Having Jurisdiction.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - 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 damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - 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.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for man-made fiber.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:

1. CertainTeed.
2. Knauf.
3. Johns Manville.
4. Owens-Corning.
5. Substitutions: Division 01 - Product Requirements.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:

1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.
4. Substitutions: Division 01 - Product Requirements.

C. Manufacturers for Polyisocyanurate Foam Insulation Products:

1. Dow Chemical Company.
2. Substitutions: Division 01 - Product Requirements.

2.2 PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees 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 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC Plastic Pipe Jacket:

1. Product Description: One piece molded type fitting covers and sheet material, off-white color.
 2. Thickness: 10 mil
- C. Aluminum Pipe Jacket:
1. ASTM B209.
 2. Thickness: 0.020 inch thick sheet.
 3. Finish: Corrugated or textured.
 4. Joining: Longitudinal slip joints and 2 inch laps.
 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

2.4 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. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- F. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- G. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- H. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 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 23 05 29 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Hot Piping Systems less than 140 degrees 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. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- E. 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: Compression resistant insulating material suitable for planned temperature range and service.
 - 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- F. Insulation Terminating Points:

1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

G. 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.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers or aluminum jacket.

I. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

J. Prepare pipe insulation for finish painting.

3.3 SCHEDULES

A. Heating Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Heating Water Supply and Return	P-1	All	1.0

END OF SECTION

SECTION 23 08 00 COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC commissioning description.
2. HVAC commissioning responsibilities.

B. Related Sections:

1. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: For requirements and procedures concerning testing, adjusting, and balancing of mechanical systems.
2. Section 23 09 00 - Instrumentation and Control for HVAC: Submittal and training requirements.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE Guideline 1 - The HVAC Commissioning Process.

B. Building Commissioning Association:

1. BCA - Commissioning Handbook.

C. National Environmental Balancing Bureau:

1. NEBB - Procedural Standards for Building Systems Commissioning.

D. Testing Adjusting and Balancing Bureau:

1. TABB - Commissioning Manual.

1.3 COMMISSIONING DESCRIPTION

A. HVAC commissioning process includes the following tasks:

1. Testing and startup of HVAC equipment and systems.

2. Equipment and system verification checks.
3. Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.
4. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
9. Provide training for systems specified in this Section with coordination by Commissioning Authority.

B. Equipment and Systems to Be Commissioned:

1. New HVAC systems that were installed under this Contract.

C. The following is a partial list of equipment that may be included in this HVAC Commissioning:

1. Pumps.
2. Boilers.
3. Piping systems.
4. Variable frequency drives.
5. Heat exchangers.
6. HVAC controls.
7. Testing, Adjusting and Balancing work.

D. Perform seasonal function performance tests for the following equipment and systems:

1. Heating equipment during heating season.

1.4 COMMISSIONING SUBMITTALS

- A. Division 01 - Commissioning: Requirements for commissioning submittals.
- B. Draft Forms: Submit draft of system verification form and functional performance test checklist.
- C. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified. Use NEBB forms as guidelines.
- D. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
- C. Operation and Maintenance Data:
 - 1. Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.
 - 2. Submit approximated system curves for each circulation pump with final pump controller settings.
 - 3. Submit list of setpoints for each balance valve.
 - 4. Submit settings for each controller, valve actuators, thermostats, and flow switches.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ASHRAE Guideline 1 requirements.

1.7 COMMISSIONING RESPONSIBILITIES

- A. Equipment or System Installer Commissioning Responsibilities:
 - 1. Attend commissioning meetings.
 - 2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
 - 3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
 - 4. Provide instructions and demonstrations for Owner's personnel.
 - 5. Ensure subcontractors perform assigned commissioning responsibilities.
 - 6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
 - 7. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for equipment and systems to be commissioned.
 - 8. During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
 - 9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
 - 10. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
 - 11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
 - 12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.

13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
15. Provide factory supervised startup services for equipment and systems. Coordinate work with manufacturer and Commissioning Authority.
16. Perform verification checks and startup on equipment and systems as specified.
17. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
18. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
19. Conduct HVAC system orientation and inspection.

B. Temperature Controls Installer Commissioning Responsibilities:

1. Attend commissioning meetings.
2. Review design for ability of systems to be controlled including the following:
 - a. Confirm proper hardware requirements exists to perform functional performance testing.
 - b. Confirm proper safeties and interlocks are included in design.
 - c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
 - d. Confirm sensors selected are within device ranges.
 - e. Review sequences of operation and obtain clarification from Architect/Engineer.
3. Inspect, check, and confirm proper operation and performance of control hardware provided in other HVAC sections.
4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
6. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements of Section 23 09 00.
7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

C. Testing, Adjusting, and Balancing Agency Commissioning Responsibilities:

1. Attend commissioning meetings.
2. Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes. Repeat sample of 10 percent of measurements contained in testing, adjusting, and balancing report as selected by Commissioning Authority.
3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.8 COMMISSIONING MEETINGS

- A. Division 01 - Commissioning: Requirements for commissioning meetings.
- B. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.9 SCHEDULING

- A. Division 01 - Administrative Requirements: Requirements for scheduling.
- B. Prepare schedule indicating anticipated start dates for the following:
 1. Piping system pressure testing.
 2. Piping system flushing and cleaning.
 3. Equipment and system startups.
 4. Automatic temperature control system checkout.
 5. Testing, adjusting, and balancing.
 6. HVAC system orientation and inspections.
 7. Operation and maintenance manual submittals.
 8. Training sessions.
- C. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.

1.10 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.
- B. Notify Commissioning Authority minimum of four weeks in advance of the following:
 1. Scheduled equipment and system startups.
 2. Scheduled automatic temperature control system checkout.
 3. Scheduled start of testing, adjusting, and balancing work.
- C. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install additional balancing valves, test ports, and pressure and temperature taps required by Commissioning Authority.
- B. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.
- C. Using calibrated temperature and pressure gauges, calibrate all temperature and pressure gauges and sensors, aquastats, and thermostats to verify accuracy within 1/2 degree Fahrenheit or 1/2 PSI.

3.2 CIRCULATION PUMPS

- A. Equipment Included:
 - 1. All hydronic and potable water centrifugal pumps
- B. Procedure:
 - 1. Open all zones valves served by circulation pump and manually override pump settings to operate at minimum speed, 50% speed, and maximum speed. Record differential pressure across pump at each speed. For fixed speed pumps, only record differential pressure at single speed.
 - 2. Obtain copy of pump performance pressure/flow chart and plot each measured pressure on corresponding pump pressure/flow curve. In red pen, sketch an approximated system curve through each of the 3 points and label it as "system curve at full flow". For single speed pump, sketch approximated curve based on single point.
 - 3. Return system to normal operation and repeat for each pump in the system.
 - 4. Identify on chart the pump operational setting (ie: sketch constant pressure line, sketch proportional pressure line, or highlight constant pump speed curve as applicable)
 - 5. Retain copy of edited pump chart, label pump that it corresponds to, and include copy in O&M submittal.

3.3 HEATING ZONE BALANCE VALVES

- A. Equipment Included:
 - 1. Zone valves

2. Circulation Pumps

B. Procedure:

1. Temporarily adjust controller settings and/or artificially create heating loads to open all heating zone valves simultaneously. Verify all zone controls operate as designed. Verify circulation pump flow rate is between 100% and 120% of its maximum design flow rate.
2. Temporarily close all zone valves.
3. Manually open each zone valve, one at a time and verify flow rates meet minimum design requirements and the following maximum pipe velocities are not exceeded.
 - a. Hydronic Heating: 3 feet/second
 - b. Domestic Hot Water: 5 feet/second
 - c. Cold Water: 7 feet/second
4. Return system to normal operation.

3.4 GLYCOL MIX TANK

A. Equipment Included:

1. Glycol mix tank, GT-1

B. Procedure:

1. Operate glycol tank to fill system throughout hydronic equipment startup and testing.
2. After all testing is complete, air is purged from hydronic system, and final flushing of strainers, isolate the glycol tank from the system and turn it off. Add glycol mixture to the makeup tank as needed to reach 80% fill line.

3.5 BOILERS

A. Equipment included:

1. Boilers
2. Boiler circulation pumps
3. Boiler controllers
4. Outside air temperature sensor
5. Glycol supply temperature sensor
6. Glycol return temperature sensor

B. Procedure

1. Verify boiler burner controls, temperature high limit, and LWCO safety features are working properly. Set high limit temperature to 190 degrees.
2. Set boiler controller settings to those listed in sequence of operations.
3. Limit length of test procedures to ensure heat trace and process water heating zones do not exceed safe operating temperatures.

4. Boiler Pump Speed Adjustment: Turn on single Boiler Circulation Pumps and select constant speed pump setting that produces design flow rates. Where multiple pump settings fall within this range, select the faster of the 2 settings. Set both pumps to the same setting and permanently affix tag on pumps noting set speed and corresponding flow rate.
5. Design Load Simulation:
 - a. After all balancing valves and pumps are balanced and verified as operating at design flow rates, turn on all heating loads simultaneously to simulate maximum heating load conditions.
 - b. Measure and record temperature drop through both primary and secondary sides of heating system at maximum load.
 - c. Document whether lag boiler turns on to meet demand.
 - d. Adjust boiler temperature controller setback curve settings as needed to ensure adequate heat will be available during peak heating load conditions.
6. Warm Weather Simulation:
 - a. Temporarily adjust boiler controller to minimum setback temperature setting.
 - b. Turn off all heating loads except hot water generator.
 - c. Turn on 1 washing machine with hot water setting and verify hot water generator output temperature does not drop more than 5 degrees during washing machine fill cycle.
 - d. Adjust boiler temperature controller setback curve warm weather setting as needed to operate at lowest allowable temperature without compromising performance of hot water generator.

3.6 HEAT EXCHANGERS

A. Equipment included:

1. Heat exchangers
2. Control Valves
3. Temperature Controllers
4. Temperature Sensors
5. Balance valves
6. Circulation Pumps

B. Procedure:

1. Calibrate temperature controllers and sensors associated with heat exchanger circulation as needed to ensure temperature readings are accurate and match other temperature gauges measuring the same water temperature.
2. Temporarily engage circulation through the cold side of the heat exchanger and verify each heating system component operates as designed through the full heating cycle.
3. Record maximum and minimum temperatures throughout typical heating cycle and verify they are within design tolerances.
4. Adjust controller settings as needed to ensure electronic components have acceptable on/off cycle durations and that actuated valves modulate to stable position within an acceptable amount of time.

3.7 FIELD TESTS AND INSPECTIONS

A. Seasonal Sensitive Functional Performance Tests:

1. Test heating equipment at winter design temperatures.
2. Participate in testing delayed beyond Substantial Completion to test performance at peak seasonal conditions.

B. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.

END OF SECTION

SECTION 23 10 00 FACILITY FUEL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Pipe and pipe fittings.

1.2 REFERENCES

- A. American Society of Mechanical Engineers
 - 1. ASME B16.3 - Malleable Iron Threaded Fittings.
 - 2. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 3. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 4. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 - 5. ASME B31.1 - Power Piping.
 - 6. ASME B31.2 – Fuel Gas Piping.
 - 7. ASME B31.9 – Building Service Piping
 - 8. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. ASTM International
 - 1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM B32 - Standard Specification for Solder Metal.
 - 3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- C. American Welding Society
 - 1. AWS 5.8 – Specification for Filler Metals for Brazing and Braze Welding
 - 2. AWS D1.1 - Structural Welding Code - Steel.
- D. National Fire Protection Association
 - 1. NFPA 30 – Flammable and Combustible Liquids Code
 - 2. NFPA 31 – Installation for of Oil Burning Equipment
- 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 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 - 4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - 5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
 - 6. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
 - 7. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

8. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

F. UL Standards

1. UL 343 – Standard for Safety Pumps for Oil-Burning Appliances
2. UL 2085 - Standard for Safety for Insulated Aboveground Tanks Flammable and Combustible Liquids.

1.3 SUBMITTALS

- A. The Contractor shall furnish to the Engineer for approval submittals indicated below. No work shall commence on any item until the required shop drawing and product submittals have been approved. The submittals shall include:
1. Shop Drawings: Submit dimensionally correct (scaled) shop drawings for all tanks to be fabricated prior to beginning fabrication. Indicate for fuel oil tanks dimensions; number, size, and location of openings; number, size, and location of manholes and accessories. Indicate dimensions, reinforcing steel size, and reinforcing steel location of foundations.
 2. Product Data: Submit manufacturer's standard printed information and literature for all materials to be incorporated in the work. Submit manufacturer's catalog information including capacity. Pumps: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes, and finishes.
 3. Manufacturer's Installation Instructions: Provide manufacturers installation instructions for all tanks, equipment, pumps, and appurtenances.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of manholes, tanks, appurtenances, and piping system location.
- B. Operation and Maintenance Data: Submit spare parts lists, exploded assembly views for tanks, and appurtenances. Maintenance and installation information for all pumps, tanks, and appurtenances.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 30.
- B. List and label pumps in accordance with UL 343.
- C. Perform Work in accordance with ASME Section IX for welding materials and procedures.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in the construction of fuel systems and welded piping systems, must be a member of the Steel Tank Institute and have 3 years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01- Product Requirements: Product storage and handling requirements.
- B. Accept pumps, tanks, piping, and appurtenances on site in shipping containers with labeling in place. Inspect for damage.

1.8 FIELD MEASUREMENTS

- A. Verify all measurements prior to fabrication.

PART 2 – PRODUCTS**2.1 GENERAL**

- A. Materials shall be new unless otherwise specified. All items of the same type shall be of the same manufacturer.

2.2 PIPE HANGERS AND SUPPORTS

- A. Conform to ASME B31.9.
- B. Provide Heavy timber supports for above grade exterior supports. Reference civil for details. All fasteners, hardware, clamps, and straps for exterior pipe supports to be hot dip galvanized.

2.3 PIPES AND FITTINGS

- 1. In accordance with Section 23 05 03.

2.4 PIPE COATING SYSTEM

- A. Above Grade Pipe:
 - 1. Prime pipe and fittings prior to shipping from factory. Prepare outer pipe and fitting surfaces by wheel abrading or sandblasting to bare metal. Prime with universal red oxide primer (Devco Rustguard 4160 OAE) to 1.5 mils minimum DFT.
 - 2. After field fabrication is complete, top coat primed pipe and fittings with two coats of ALKYD enamel (Devco Speedenamel 4318 OAE). Color shall be safety yellow.
 - 3. Provide flow direction arrows and pipe identification on all above grade piping. Arrows may be painted stencils or high quality printed stickers. Maximum flow direction arrow spacing shall be 10 feet measured along pipe length, minimum of one arrow per pipe segment. Color shall be black.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions as shown in the Contract Drawings.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION

- A. Install oil piping in accordance with ASME B31.2.
- B. Install oil piping in accordance with NFPA 31.
- C. Where required, bend pipe with pipe bending tools in accordance with procedures intended for that purpose.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment. Install valves to allow full operation without obstruction of operating handle.
- E. Install identification on piping systems in accordance with specifications.
- F. Make threaded joints using pipe joint compound applied to the male threads. Hercules Grip, no substitution.
- G. Provide clearance for access to valves and fittings.
- H. Electrical installation shall be in accordance with NEC and Technical Specifications.
- I. Support piping and equipment as shown on the drawings using specified supports and fasteners. If not detailed on the drawings, support from structural members with pipe hangers, clamps or pipe straps specifically intended for the application. Do not support piping from connections to equipment.
- J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- K. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

3.3 TESTING

- A. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated and serviced in accordance with factory instructions.
- B. Test piping as follows:
 - 1. Isolate and pressure test each run of piping at 125 psig minimum pressure for a minimum of one hour. In order to pass the pressure test there shall be no loss of pressure during the test period. Provide blind flanges, threaded caps or plugs at each end of the test section as needed. Test 100% of welds visually for leaks with a leak detection solution. Do not conceal pipe joints before pressure testing is complete. Isolate equipment and components rated for lesser pressures so as not to damage these.
 - 2. Pressure test piping system again after all equipment is installed at 75 psi for a minimum of one (1) hour, or the maximum rated pressure of the weakest component, whichever is

- less. Test 100% of welds and pipe joints for leaks with a leak detection solution. Piping system shall maintain pressure for one hour minimum.
3. Notify Architect/Engineers in writing seven (7) days in advance of pressure tests.
 4. Pressure shall be maintained for sufficient time to complete the visual inspection of all joints but shall be not be less than one (1) hour.
 5. Care shall be taken to ensure that these pressures are not applied to tanks.
 6. Repair any leakage found and retest until system proves leak-free. Retesting after the repair of defects shall be performed at no cost to the Owner.
 7. Certified test results shall be submitted to the Architect/Engineer for approval.
 - a. Test certification shall include gauge pressure, air temperature, time, date, witness signature, and pipeline identification.
- C. Pressure test building fuel oil piping in accordance with NFPA 31.

END OF SECTION

SECTION 23 21 16 HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pressure gages.
2. Pressure gage taps.
3. Thermometers.
4. Thermometer supports.
5. Test plugs.
6. Flexible connectors.
7. Diaphragm-type expansion tanks.
8. Air vents.
9. Air separators.
10. Strainers.
11. Balance valves.
12. Relief valves.
13. Glycol charging equipment.
14. Glycol solution.

B. Related Sections:

1. Section 23 05 03 - Hydronic Piping: Execution requirements for piping connections to products specified by this section.
2. Section 23 21 23 - Hydronic Pumps: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.
2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

C. American Water Works Association:

1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
3. AWWA C702 - Cold-Water Meters - Compound Type.
4. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

D. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 PERFORMANCE REQUIREMENTS

- A. Flexible Connectors: Provide at or near pumps where piping configuration does not absorb vibration.

1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for manufactured products and assemblies used in this Project.
1. Manufacturer's data indicating use, operating range, total range, accuracy, and location for manufactured components.
 2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
 3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
 4. Submit electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of actual locations of components and instrumentation.

- C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.6 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 approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements before fabrication.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Maintenance service.

1.12 MAINTENANCE MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance materials.

1.13 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS**2.1 PRESSURE GAGES**

- A. Manufacturers:
 - 1. Dwyer.
 - 2. Trerice.
 - 3. Ashcroft.
 - 4. Substitutions: Division 01 - Product Requirements.
- B. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
- C. Case: Cast aluminum.
- D. Bourdon Tube: Phosphor bronze.
 - 1. Dial Size: 4-1/2 inch diameter.
 - 2. Mid-Scale Accuracy: One percent.
 - 3. Scale: 40 PSI.

2.2 PRESSURE GAGE TAPS

- A. Manufacturers:
 - 1. Dwyer.
 - 2. Trerice.
 - 3. Ashcroft.
 - 4. Substitutions: Division 01 - Product Requirements.

- B. Ball Valve: Brass, 1/4 inch NPT for 250 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.
- D. Siphon: Brass, 1/4 inch NPT angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Trerice.
 - 2. Substitutions: Division 01 - Product Requirements.
- B. Thermometer: ASTM E1, red appearing mercury, lens front tube, cast aluminum case with enamel finish.
 - 1. Size: 9 inch scale.
 - 2. Window: Clear Lexan.
 - 3. Stem: Brass, 3/4 inch NPT.
 - 4. Accuracy: 2 percent.
 - 5. Scale: 30-240 Degrees F.

2.4 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions, and with cap and chain.
- B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.5 TEST PLUGS

- A. Manufacturers:
 - 1. Sisco.
 - 2. Substitutions: Division 01 - Product Requirements.
- B. 1/4 inch NPT or 1/2 inch NPT brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:
 - 1. Neoprene core for temperatures up to 200 degrees F.
 - 2. Nordel core for temperatures up to 350 degrees F.
 - 3. Viton core for temperatures up to 400 degrees F.

C. Test Kit:

1. Carrying case, internally padded and fitted containing:
 - a. One 2-1/2 inch diameter pressure gages.
 - b. Two gage adapters with 1/8 inch probes.
 - c. Two 1-1/2 inch dial thermometers.

2.6 FLEXIBLE CONNECTORS

- A. Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 500 psig.

2.7 DIAPHRAGM-TYPE EXPANSION TANKS

A. Manufacturers:

1. Amtrol.
2. Bell & Gossett.
3. Armstrong.
4. Substitutions: Division 01 - Product Requirements.

- B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible butyl EPDM diaphragm sealed into tank.

- C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

2.8 AIR VENTS

A. Manufacturers:

1. Taco.
2. Hoffman.
3. Bell & Gosset.
4. Substitutions: Division 01 - Product Requirements.

- B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

- C. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.9 AIR SEPERATORS

A. Manufacturers:

1. Spirotherm.
2. Taco.
3. Substitutions: Division 01 - Product Requirements.

B. Dip Tube Fitting: For 125 psig operating pressure; to prevent free air collected in boiler from rising into system.

C. In-line Air Separators: Cast iron for sizes 1-1/2 inch and smaller, or steel for sizes 2 inch and larger; tested and stamped in accordance with ASME Section VIII; for 125 psig operating pressure.

2.10 STRAINERS

A. Manufacturers:

1. Bell & Gossett.
2. Taco.
3. Armstrong.
4. Substitutions: Division 01 - Product Requirements.

B. Size 2 inch and Smaller:

1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel

2.11 BALANCE VALVES

A. Manufacturers:

1. Bell & Gossett.
2. Taco.
3. Armstrong.
4. Griswold.
5. Substitutions: Division 01 - Product Requirements.

- B. Angle or straight pattern, rising stem, inside screw globe valve for 125 psig working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lock-shield key cap and set screw memory bonnet for balancing service.

2.12 RELIEF VALVES

A. Manufacturers:

1. Watts; a Watts Water Technologies, Company.
2. Zurn Industries, LLC.
3. Substitutions: Division 01 - Product Requirements.

- B. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.13 GLYCOL CHARGING

- A. 48 U.S. gallon HDPE storage/mixing tank with cover; pump suction hose with inlet strainer; pressure pump with thermal cut-out; integral pressure switch; integral check valve; cord and plug; pre-charged accumulator tank with EPDM diaphragm; manual diverter valve for purging air and agitating contents of storage tank; 5 to 55 psi pressure adjustable regulating valve complete with pressure gauge; integral replaceable strainer; built-in check valve; union connection; 36" long flexible connection hose with check valve; low level pump cut-out. Pressure pump shall be capable of running dry without damage. Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA standard C22.2 No 68.

2.14 GLYCOL SOLUTION

A. Manufacturers:

1. Dow Chemical.
2. Substitutions: Division 01 - Product Requirements.

- B. Inhibited propylene glycol and water solution mixed 50 percent glycol - 50 percent water, suitable for operating temperatures from -50 degrees F to 325 degrees F.

PART 3 - EXECUTION

3.1 INSTALLATION - THERMOMETERS AND GAGES

- A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
- B. Install gage taps in piping.
- C. Install pressure gages with pulsation dampers. Provide valve to isolate each gage. Extend nipples to allow clearance from insulation.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- F. Coil and conceal excess capillary on remote element instruments.
- G. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

- A. Where large air quantities accumulate, provide enlarged air collection standpipes.
- B. Install manual air vents at system high points.
- C. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.
- D. Provide air scoop on suction side of system circulation pump.
- E. Provide drain and hose connection with valve on strainer blow down connection.

- F. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- G. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- H. Pipe relief valve outlet to nearest floor drain.
- I. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- J. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Pressure system cold at 5 psig.

3.3 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements and 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test for strength of glycol and water solution and submit written test results.

3.4 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean and flush glycol system before adding glycol solution.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting installed construction.
- B. Do not install hydronic pressure gauges until after systems are pressure tested.

END OF SECTION

SECTION 23 21 23

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line circulators.

B. Related Sections:

1. Section 23 05 00 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
2. Section 23 05 23 - General-Duty Valves for HVAC Piping: Product requirements for valves used in hydronic piping systems.
3. Section 23 05 03 - Hydronic Piping: Execution requirements for connection to pumps specified by this section.
4. Section 23 21 16 - Hydronic Piping Specialties: Product and execution requirements for piping specialties installed in hydronic systems adjacent to pumps.
5. Division 26 - Equipment Wiring Connections: Execution requirements for electrical connections to pumps specified by this section.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. Underwriters Laboratories Inc.:

1. UL 778 - Motor Operated Water Pumps.

1.3 PERFORMANCE REQUIREMENTS

- A.** Provide pumps to operate at system fluid temperatures indicated on Drawings without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit hanging and support requirements and recommendations.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Protect systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pumps.

1.10 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS**2.1 IN-LINE CIRCULATORS**

- A. Manufacturers:
 - 1. Grundfos.
 - 2. Taco.
 - 3. Substitutions: Division 01 – Product Requirements.
- B. Type: Maintenance free, self-lubricated, 3 speed industrial/commercial single stage, direct drive circulator.
- C. Casing: Cast iron.
- D. Impeller: Type 304 stainless steel.
- E. Bearings: Upper and lower radial bearings to be aluminum oxide ceramic, tungsten carbide shaft bearing surfaces.
- F. Shaft: Stainless steel with type 430F.

2.2 VFD CONTROLLED IN-LINE CIRCULATORS

- A. Manufacturers:
 - 1. Grundfos.
 - 2. Taco.
 - 3. Substitutions: Division 01 - Product Requirements.
- B. Type: Maintenance free, self-lubricated, pump mounted VFD controlled industrial/commercial single stage, direct drive circulator.

- C. Differential pressure monitoring.
- D. Casing: Cast iron.
- E. Impeller: Type 304 stainless steel.
- F. Bearings: Upper and lower radial bearings to be aluminum oxide ceramic, tungsten carbide shaft bearing surfaces.
- G. Shaft: Stainless steel with type 430F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings.
- C. Install flexible connectors at or near pumps where piping configuration does not absorb vibration. Refer to Section 23 21 16.
- D. Provide drains for bases and seals.
- E. Lubricate pumps before start-up.

3.2 FIELD QUALITY CONTROL

- A. Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

END OF SECTION

SECTION 23 52 23 CAST-IRON BOILERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-iron boilers.
2. Boiler controls.
3. Hot water boiler trim.
4. Fuel oil fired burner.

B. Related Sections:

1. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to boilers specified in this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.13 - Gas-fired Low Pressure Steam and Hot Water Boilers.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. American Society of Mechanical Engineers:

1. ASME Section I - Boiler and Pressure Vessel Code - Power Boilers.
2. ASME Section IV - Boiler and Pressure Vessel Code - Heating Boilers.
3. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. Hydronics Institute:

1. H.I. Heating Boiler Standard - Testing and Rating Standard for Heating Boilers.

E. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. National Fire Protection Association:

1. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

2. NFPA 54 - National Fuel Gas Code.
3. NFPA 58 - Liquefied Petroleum Gas Code.

G. Underwriters Laboratories Inc.:

1. UL 726 - Oil-Fired Boiler Assemblies.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit capacities and accessories included with boiler. Include general layout, dimensions, size and location of water, fuel, electric and vent connections, electrical characteristics, weight and mounting loads.
- C. Test Reports: Indicate boilers meet or exceed specified performance and efficiency. Submit results of combustion test.
- D. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Manufacturers Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

1.5 QUALITY ASSURANCE

- A. Conform to ASME Section IV for construction of boilers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.
- B. Boiler Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with H.I. Heating Boiler Standard.
- C. Gas Train and Safety Controls: Conform to requirements of Factory Mutual (FM).
- D. Unit Certification: UL certified.

- E. Conform to applicable code for internal wiring of factory wired equipment.
- F. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for purpose specified and indicated.
- G. Perform Work in accordance with State of Alaska Standards and as amended by the local authority having jurisdiction.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept boilers and accessories on site in factory shipping packaging. Inspect for damage.
- C. Protect boilers from damage by leaving packing in place until installation.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for boilers.

1.10 MAINTENANCE SERVICE

- A. Division 01- Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of boilers for one year from Date of Substantial Completion.
- C. Provide emergency call back service at all hours for this maintenance period.

- D. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
- E. Perform maintenance work using qualified personnel under supervision of boiler manufacturer's representative.

1.11 MAINTENANCE MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

1.12 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one set of circulator pump seals.

PART 2 - PRODUCTS

2.1 CAST-IRON BOILERS

- A. Manufacturers:
 - 1. Burnham Hydronics.
 - 2. Peerless Boilers.
 - 3. Weil-McLain.
 - 4. Substitutions: Division 01 - Product Requirements.
- B. Product Description: Hot Water boilers with forced draft, insulated jacket, sectional cast-iron heat exchanger, fuel oil burning system, controls.
- C. Boiler Fabrication:
 - 1. Assembly: Boilers shall be constructed of cast iron sections manufactured in accordance with ASME requirements for low pressure boilers and each section shall be permanently marked with the ASME symbol and the maximum allowable workable pressure. .
 - 2. Furnish access for flue passages for cleaning.
 - 3. The boiler-burner mounting plate shall be lined with lightweight refractory insulation and shall have built-in observation port with closure cover.
 - 4. Boiler sections shall have pin-like projections on each center section, evenly spaced on the vertical flue surfaces to extract the greatest possible heating value from the hot flue gases.
 - 5. Boiler sections shall be surface ground to ensure smooth positive mating surfaces.

6. Boiler sections shall be assembled with precision machined cast iron push nipples, pressed into a mating machined nipple port in the section eliminating the need for any gasket material which would be subject to deterioration due to corrosion or oil based chemicals. The sections are to be assembled with short draw rods.
7. A gas-tight seal, which is imperative for forced draft boilers, will be achieved with the application of a silastic sealant in a finished ground groove between sections.
8. Washout tappings shall be provided in both the front and back boiler sections. Blowoff tapping shall be provided in the back boiler section.
9. Boiler shall have individual cleanout openings between sections covered with insulated steel covers to insure a gas-tight seal.
10. Boiler flue canopy shall be constructed of heavy gauge aluminized steel and shall be concealed under an insulated steel boiler jacket.
11. The boiler flue connector shall be top outlet and securely fastened and sealed to the canopy and shall contain a lock-type adjustable damper with test tapping.
12. The boiler jacket shall be constructed of heavy gauge steel with 1" insulation and have a rust resistant baked enamel finish. The jacket shall be capable of being installed after system piping has been connected to the boiler section assembly. Jacket will have removable side panels so that the jacket can be removed for cleaning without removing any screws or disturbing the system piping.
13. The boiler shall be furnished with a rear flame observation port.

D. Hot Water Boiler Trim:

1. ASME rated pressure relief valve, 50 psig.
2. Combination water pressure and temperature gage. Furnish graduated pressure gage scale from 1-1/2 to 3 times pressure relief valve pressure setting.
3. Low water cut-off to prevent burner operation when boiler water falls below safe level.
4. Operating temperature controller with outdoor reset to maintain boiler water temperature.
5. High limit temperature controller with manual reset for burner to prevent boiler water temperature from exceeding safe system temperature.
6. Boiler air vent.
7. Control transformer.
8. Drain valve.
9. Circulator relay.
10. Combination high and low limit control.
11. High limit pressure control with manual reset for burner to prevent steam pressure from exceeding system pressure.
12. Low limit pressure control.

E. Boiler Fuel Burning System:

1. Burner Operation: On-off with low fire position for ignition.
2. UL/cUL listed
3. Oil Burner: High pressure atomizing type for No. 2 fuel oil with combustion air blower, fuel pump, hinged flame inspection port, cadmium sulfide flame sensor, electrodes, ignition transformer, and oil nozzle, fuel filter.

4. Oil Burner Safety Controls: Energize burner motor and electric ignition, limit time for establishment of main flame, monitor flame continuously during burner operation and stop burner on flame failure with manual reset necessary, solenoid oil delay valve opens after burner motor energized and closes when de-energized.

F. Boiler Performance:

1. Capacity:
 - a. Per mechanical drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble boiler from knockdown configuration after transporting into boiler room. Perform pressure test on boiler after assembly in accordance with the following:
 1. Pressure test before connecting fuel oil piping, electrical connections, and controls.
 2. Install boiler drain and pressure gage.
 3. Plug remaining openings.
 4. Fill boiler with water and vent air.
 5. Pressure test to 1-1/2 times working pressure for water boilers for 10 minutes with no leaks.
 6. Repair leaks and retest.
 7. After successful test, drain and remove plugs from openings to be used for piping connections and controls.
- B. Install boilers plumb and level, to plus or minus 1/16 inch over boiler base.
- C. Maintain manufacturer's recommended clearances around and over boilers.
- D. Install boiler on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than boiler base on each side.
- E. Install boiler on vibration isolators.
- F. Connect fuel oil piping in accordance with NFPA 31.
- G. Connect fuel oil piping to boiler, full size of boiler gas train inlet. Arrange piping with clearances for burner removal and service.
- H. Connect hot water piping to supply and return boiler connections.
- I. Install the following piping accessories.
 1. On supply:

- a. Thermometer well for temperature controller.
 - b. Thermometer well and thermometer.
 - c. Well for control system temperature sensor.
 - d. Strainer.
 - e. Nipple and flow switch.
 - f. Pressure gage.
 - g. Shutoff valve.
- 2. On return:
 - a. Thermometer well and thermometer.
 - b. Well for control system temperature sensor.
 - c. Pressure gage.
 - d. Shutoff valve.
 - e. Balancing valve.
- J. Install discharge piping from relief valves and drain valves to nearest floor drain.
- K. Install boiler trim and accessories furnished loose for field mounting.
- L. Install electrical devices furnished loose for field mounting.
- M. Install control wiring between boiler control panel and field mounted control devices.
- N. Connect flue to boiler outlet, full size of outlet.
- O. Install Work in accordance with State of Alaska standards and as amended by the by the local authority having jurisdiction.

3.2 FIELD QUALITY CONTROL

- A. Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform combustion test including boiler firing rate, over fire draft, fuel flow rate, heat input, burner manifold gas pressure, percent carbon monoxide, percent oxygen, percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output. Perform test at minimum, mid-range, and high fire.
- C. Arrange with local authorities having jurisdiction for inspection of boiler, piping, and for certificate of operation.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.

- B. Start-up boilers according to manufacturer's start-up instructions and in presence of boiler manufacturer's representative. Test controls and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.

3.5 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.

3.6 DEMONSTRATION

- A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate operation and maintenance procedures.
- C. Furnish services for manufacturer's technical representative for one 4 hour day to instruct Owner's personnel in operation and maintenance of boilers. Schedule training with Owner, provide at least 7 days notice to Engineer of training date.

END OF SECTION

SECTION 23 57 00 HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes brazed plate type heat exchangers, plate type heat exchangers and accessories and trim.
- B. Related Sections:
 - 1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Execution requirements for heat exchanger supports specified by this section.
 - 2. Section 23 07 00 - HVAC Insulation: Field applied insulation for heat exchangers.
 - 3. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for heat exchanger trim for placement by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate dimensions, locations, size of taps, and support frame.
- C. Product Data: Submit performance data.
- D. Test Reports: Indicate shop test reports of tube bundle shop pressure tests.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

- B. Operation and Maintenance Data: Submit start-up and shut down instructions, assembly drawings, and spare parts lists.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alaska standards and as amended by the local authority having jurisdiction.

1.6 QUALIFICATIONS

- A. Manufacturer: 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 years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept heat exchangers on site in factory protective packaging. Inspect for damage.
- C. Protect openings with temporary caps to prevent entry of foreign material.

1.8 WARRANTY

- A. Division 01- Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five year manufacturer's warranty for heat exchangers

PART 2 - PRODUCTS

2.1 SINGLE WALL BRAZED PLATE HEAT EXCHANGERS

- A. Manufacturers:
 - 1. Taco
 - 2. Kelvion
 - 3. Tranter, Inc.

- 4. GEA.
- 5. Substitutions: Division 01 - Product Requirements.
- B. Construction: Braze alloy to be copper 99.9% and connector to be 304 stainless steel.
- C. Plates: Single wall, Stainless steel Type 316L.
- D. Maximum allowable working pressure rating 650 psig and temperature rating 350°F.
- E. Heat Exchanger Performance: See schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install Work in accordance with State of Alaska standards and as amended by the local authority having jurisdiction.
- B. Support heat exchangers on welded steel pipe and angle floor stand or as noted on drawings.
- C. Make connections to heat exchangers with unions or flanges.
- D. Install heat exchanger to allow draining and install drain connection at low point.
- E. Pipe in counter flow direction.
- F. Install pressure relief valve on outlet of heating load and pipe to nearest floor drain.
- G. Install strainers with blow-down valves on both inlets.
- H. Install low point drains, high point vents, and isolation valves on both sides of heat exchanger.
- I. Additionally, install valves and piping specialties in accordance with details as indicated on Drawings.

END OF SECTION

DIVISION 26 ELECTRICAL

SECTION 26 00 00
ELECTRICAL WORK GENERAL

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. The Contractor must provide electrical Work, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section apply to all sections in Division 26, except as indicated otherwise.
- C. The Work of this Section is required for operation of electrically-driven equipment provided under specifications in other Divisions and as shown on the plans. The Contractor's attention is directed to the requirement for proper coordination of the Work of this Section with the Work of equipment specifications, and the Work of instrumentation sections.
- D. Concrete, excavation, backfill, and steel reinforcement required for foundation, installation, or construction of the Work of the various sections of Division 26 is included as a part of the Work under the respective sections or as required.

1.2 REFERENCE STANDARDS

- A. The Work of this Section and all sections in Division 26 must comply with the following, as applicable:

NEC (NFPA 70)	National Electrical Code
NETA	International Electrical Testing Association
NEMA 250	Enclosure for Electrical Equipment (1000 Volts Maximum)

Anchorage Electrical Code amendments to the NEC.
- B. Electrical equipment must be listed by and must bear the label of an OSHA approved NRTL (Nationally Recognized Testing Laboratory)
- C. Installation of electrical equipment and materials must comply with OSHA Safety and Health Standards, state building standards, and applicable local codes and regulations.
- D. Where the requirements of the specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements must govern.

1.3 SIGNAGE

- A. Local Disconnect Switches:
 - 1. Each local disconnect switch for motors and equipment must be legibly marked to indicate its purpose, unless the purpose is indicated by the location and arrangement.

- B. Warning Signs:
 - 1. 600 volts nominal, or less. – Entrances to rooms and other guarded locations that contain live parts must be marked with conspicuous signs prohibiting entry by unqualified persons.
- C. Isolating Switches: Isolating switches not interlocked with an approved circuit interrupting device must be provided with a sign warning against opening them under load.

1.4 PUBLIC UTILITIES REQUIREMENTS

- A. The Contractor must contact the local serving utility and verify compliance with their service requirements before construction. The Contractor must coordinate schedules and payments for Work by all utilities.
- B. Electrical service must be provided as indicated and be as required by the serving utility.
- C. The Contractor must verify and provide all service conduits, fittings, grounding devices, and all service wires not provided by the serving utility.
- D. The Contractor must verify with the utility the exact location of each service point and type of service, and must pay all charges levied by the serving utilities as part of the Work.

1.5 PERMITS AND INSPECTION

- A. All electrical permits must be obtained and inspection fees must be paid by the Contractor.
- B. All electrical permits must be obtained by the Contractor.
- C. The Contractor must pay all connection and turn-on service charges required by the utility company.

1.6 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance Section 01 30 00 – Submittal Procedures.
- B. Shop Drawings: Include the following:
 - 1. Complete material lists stating manufacturer and brand name of each item or class of material.
 - 2. Shop Drawings for all grounding Work not specifically indicated.
 - 3. Front, side, rear elevations, and top views with dimensional data.
 - 4. Location of conduit entrances and access plates.
 - 5. Component data.
 - 6. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers.
 - 7. Method of anchoring, seismic requirements, weight.
 - 8. Types of materials and finish.
 - 9. Nameplates.

10. Temperature limitations, as applicable.
 11. Voltage requirement, phase, and current, as applicable.
 12. Front and rear access requirements.
 13. Test reports.
 14. Grounding requirements.
 15. Catalog cuts of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material. Catalog data sheets must be stamped to indicate the project name, applicable Section and paragraph, model number, and options. This information must be marked in spaces designated for such data in the ENGINEER's stamp.
- C. Shop Drawings must be custom prepared. Drawings or data indicating "optional" or "as required" equipment are not acceptable. Options not proposed must be crossed out or deleted from Shop Drawings.
- D. Materials and Equipment Schedules: The Contractor must deliver to the ENGINEER within 30 days of the commencement date in the Notice to Proceed, a complete list of all materials, equipment, apparatus, and fixtures proposed for use. The list must include type, sizes, names of manufacturers, catalog numbers, and other such information required to identify the items.
- E. Owner's Manuals: Complete information in accordance with Section 01 70 00 – Execution Requirements: Operation and Maintenance Data.
- F. Record Drawings: The Contractor must show invert and top elevations and routing of all duct banks and concealed below-grade electrical installations. Record Drawings must be prepared, be available to the ENGINEER, and be submitted in accordance with Section 01 70 00 – Execution Requirements: Project Record Documents.

1.7 AREA DESIGNATIONS

- A. General:
1. Raceway systems and enclosures must comply with Section 26 05 33 – Electrical Raceways and Boxes for Electrical Systems.
 2. Electrical Work specifically indicated in sections within any of the Specifications must comply with those requirements.
 3. Electrical Work in below ground facilities and outdoors must be NEMA 4 or 4X in addition to any area classification.
- B. Material Requirements:
1. NEMA 12 enclosures must be steel, coated with ANSI 61 grey paint.

1.8 TESTS

- A. The Contractor must be responsible for factory and field tests required by specifications in Division 26 and Division 40 and by the ENGINEER or other authorities having jurisdiction. The Contractor must furnish necessary testing equipment and pay costs of tests, including all replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of faulty installation.

- B. Where test reports are indicated, proof of design test reports for mass-produced equipment must be submitted with the Shop Drawings, and factory performance test reports for custom-manufactured equipment must be submitted and be approved prior to shipment. Field test reports must be submitted for review prior to Substantial Completion.
- C. Equipment or material which fails a test must be removed and replaced.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Equipment and materials must be new, must be listed by a third party Listing Laboratory acceptable to the State of Alaska Department of Labor Mechanical Inspections Division. Examples include U/L, ETL, FM/US, CSA/US. Equipment and materials must be the products of experienced and reputable manufacturers in the industry. Similar items in the Work must be products of the same manufacturer. Equipment and materials must be of industrial grade standard of construction.
- B. Where a NEMA enclosure type is indicated in a non-hazardous location, the Contractor must utilize that type of enclosure, despite the fact that certain modifications, such as cutouts for control devices, may negate the NEMA rating.

2.2 MOUNTING HARDWARE

- A. Miscellaneous Hardware:
 - 1. Nuts, bolts, and washers must be stainless steel.
 - 2. Strut for mounting of raceways and equipment must be galvanized or stainless steel as required by the area classification. Where contact with concrete or dissimilar metals may cause galvanic corrosion, suitable non-metallic insulators must be utilized to prevent such corrosion. Strut must be as manufactured by **Unistrut**, **B-Line**, or equal.
 - 3. Anchors for attaching equipment to concrete walls, floors and ceilings must be stainless steel expansion anchors, such as "**Rawl-Bolt**," "**Rawl-Stud**" or "**Lok-Bolt**" as manufactured by **Rawl**; similar by **Star**, or equal. Wood plugs must not be permitted.

2.3 ELECTRICAL IDENTIFICATION

- A. Nameplates: Nameplates must be fabricated from black-letter, white-face laminated plastic lamacoid, engraving stock, **Formica type ES-1**, or equal. Each must be fastened securely, using fasteners of brass, cadmium-plated steel, or stainless steel, screwed into inserts or tapped holes, as required by area classification. Engraved characters must be block style, with no characters smaller than 1/8-inch in height.
- B. Conductor and Equipment Identification: Conductor and equipment identification devices must be heat-shrink plastic tubing with machine printing. Lettering must read from left to right and must face toward the front of the panel.

PART 3 - EXECUTION

3.1 GENERAL

- A. Incidentals: The Contractor must provide all materials and incidentals required for a complete and operable system, even if not required explicitly by the Specifications or the Drawings. Typical incidentals are terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and control wiring required by vendor-furnished equipment to connect with other equipment indicated in the Contract Documents.
- B. Field Control of Location and Arrangement: The Drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items. Exact locations must be determined by the Contractor in the field, based on the physical size and arrangement of equipment, finished elevations, and other obstructions. Locations on the Drawings, however, must be followed as closely as possible.
 - 1. Where raceway development drawings, or "home runs," are shown, the Contractor must route the raceways in accordance with the indicated installation requirements. Routings must be exposed.
 - 2. Conduit and equipment must be installed in such a manner as to avoid all obstructions and to preserve headroom and keep openings and passageways clear. Lighting fixtures, switches, convenience outlets, and similar items must be located as indicated. Where the Drawings do not indicate exact locations, the ENGINEER must determine such locations. If equipment is installed without instruction and must be moved, it must be moved without additional cost to the OWNER. New lighting fixture locations must be adjusted slightly to avoid obstructions and to minimize shadows.
 - 3. Wherever raceways and wiring for lighting and receptacles are not indicated, it must be the Contractor's responsibility to provide all lighting and receptacle-related conduits and wiring as required, based on the actual installed fixture layout and the circuit designations as indicated. Wiring must be #12 AWG minimum, and conduits must be 1/2-inch minimum. Where circuits are combined in the field in the same raceway, the Contractor must de-rate conductor ampacities in accordance with NEC requirements.
- C. Workmanship: Materials and equipment must be installed in strict accordance with printed recommendations of the manufacturer. Installation must be accomplished by Workers skilled in the Work. Installation must be coordinated in the field with other trades to avoid interferences.
- D. Protection of Equipment and Materials: The Contractor must fully protect materials and equipment against damage from any cause. Materials and equipment, both in storage and during construction, must be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts must be kept clean and dry. The Contractor must replace or refinish damaged materials or equipment, including faceplates of panels and switchboard sections, as part of the Work.
- E. Incoming utility power equipment must be provided in conformance with the utility's requirements.
- F. Conduit and chase penetrations:

1. Exterior penetrations must be provided with non-hardening duct sealant to mitigate frost and condensation.
2. All penetrations must be provided in a manner that maintains gastight or vapor tight requirements that may exist.

3.2 CORE DRILLING

- A. The Contractor must perform core drilling required for installation of raceways through concrete walls and floors if required. Locations of floor penetrations, as may be required, must be based on field conditions. Verify all exact core drilling locations based on equipment actually furnished, as well as exact field placement. To the extent possible, identify the existence and locations of encased raceways and other piping in existing walls and floors with the OWNER prior to any core drilling activities. Damage to any encased conduits, wiring, and piping must be repaired as part of the Work.
- B. All penetrations required to extend raceways through concrete walls, roofs, and floors or masonry walls must be core drilled.

3.3 EQUIPMENT ANCHORING

- A. Floor supported, wall-, or ceiling-hung equipment and conductors must be anchored in place by methods that will meet seismic requirements in the area where the project is located. Wall-mounted panels that weigh more than 500 pounds, or which are within 18 inches of the floor, must be provided with fabricated steel support pedestals. If the supported equipment is a panel or cabinet enclosed within removable side plates, it must match supported equipment in physical appearance and dimensions. Transformers hung from 4-inch stud walls and weighing more than 300 pounds must have auxiliary floor supports.
- B. Anchoring methods and leveling criteria in the printed recommendations of the equipment manufacturers are a part of the Work of this Contract.
- C. Panels, raceways, and other equipment must be anchored and supported for Seismic requirements for Zone 2B.
- D. Select materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and raceway, including weight of wire and cable in raceway. Anchor and fasten electrical products to building elements and finishes as follows:
 1. Concrete Structural Elements: Expansion anchors.
 2. Steel Structural Elements: Beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 3. Concrete Surfaces: Self-drilling anchors and expansion anchors.
 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
 5. Solid Masonry Walls: Expansion anchors and preset inserts.
 6. Sheet Metal: Sheet metal screws.
 7. Wood Elements: Wood screws.

3.4 EQUIPMENT IDENTIFICATION

- A. General: Equipment and devices must be identified as follows:
 - 1. Nameplates must be provided for all panelboards, control and instrumentation panels, starters, switches, and pushbutton stations. In addition to nameplates, control devices must be equipped with standard collar-type legend plates.
 - 2. Control devices within enclosures must be identified as indicated. Identification must be similar to the subparagraph above.
 - 3. Equipment names and tag numbers, where indicated on the Drawings, must be utilized on all nameplates.
 - 4. The Contractor must furnish typewritten circuit directories for panelboards; circuit directory must accurately reflect the equipment connected to each circuit.
 - 5. Generator receptacles must be identified with the incoming service voltage with 1" lettering.
 - 6. Generator transfer switches must be labeled "Main" and "Generator" with ½" lettering.

3.5 CLEANING

- A. Before final acceptance, the electrical Work must be thoroughly cleaned. Exposed parts must be thoroughly clean of cement, plaster, and other materials. Oil and grease spots must be removed with a non-flammable cleaning solvent. Such surfaces must be carefully wiped and all cracks and corners cleaned out. Touch-up paint must be applied to scratches on panels and cabinets. Electrical cabinets or enclosures must be vacuum-cleaned.
- B. Contractor must group, coil, and tie wrap all spare cables at the bottom of the Local Control Panels. The wires must be grouped according to the device, control panel, or MCC section they originate from. Cable groups must be tagged according to their point of origin.
- C. All debris must be removed from the void below the panels.

3.6 CONTROL PANEL WIRING

- A. The Contractor must ensure all panels are listed as an assembly upon completion of the Work.

END OF SECTION

SECTION 26 05 03

EQUIPMENT WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes electrical connections to equipment.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.
 - 2. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 01 60 00 – Product Requirements.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

- A. Manufacturers:
 - 1. Leviton Manufacturing Co., Inc.
 - 2. Pass & Seymour/Legrand (Pass & Seymour).
 - 3. Square D; by Schneider Electric.
 - 4. Hubbell / Kellems Inc.
 - 5. Substitutions: Section 01 60 00 – Product Requirements.
- B. Attachment Plug Construction: Conform to NEMA WD 1.
- C. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.
- D. Cord Construction: Type SOWA multi-conductor flexible cords with identified equipment grounding conductor, suitable for use in Arctic locations.
- E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

2.2 SPECIALTY RECEPTACLE AND CONNECTOR BODY ASSEMBLIES

- A. Provide as shown on the plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

- A. Make all electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install receptacle outlet to accommodate connection with attachment plug.
- E. Install cord and cap for field-supplied attachment plug.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.3 ADJUSTING

- A. Section 01 70 00 - Execution Requirements: Testing, adjusting, and balancing.
- B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION

SECTION 26 05 19**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.
 - 2. Section 26 05 53 - Identification for Electrical Systems.
 - 3. Section 31 05 13 – Soils for Earthwork.
 - 4. Section 31 23 16 – Excavation and Trenching.

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
 - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
 - 1. Stranded conductor for feeders and branch circuits 10 AWG and smaller.
 - 2. Stranded conductors for control circuits.
 - 3. Conductor not smaller than 12 AWG for power and lighting circuits.
 - 4. Conductor not smaller than 16 AWG for control circuits.
 - 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
- B. Wiring Methods: Provide the following wiring methods:
 - 1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway.

2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway.
3. Wet or Damp Interior Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
4. Exterior Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
5. Underground Locations: Use only building wire, Type XHHW-2 insulation, in raceway.

1.4 SUBMITTALS

- A. Section 26 00 00 - Electrical Work, General.
- B. Product Data: Submit for building wire and each cable assembly type.
- C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- D. Test Reports: Indicate procedures and values obtained.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NEC.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

1.9 COORDINATION

- A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.
- B. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:

1. Aetna Insulated Wire, Inc.
 2. General Cable; General Cable Corporation.
 3. Southwire Company.
 4. Substitutions: Section 01 60 00 - Product Requirements.
 5. Or approved equal.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Temperature Rating: 90 degrees C.
- F. Insulation THHN/THHW, XHHW-2

2.2 WIRING CONNECTORS

- A. Manufacturers; Split Bolt Connectors:
1. Burndy; Part of Hubbell Electrical Systems.
 2. ILSCO.
 3. Thomas & Betts Corporation; a member of the ABB Group.
 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Manufacturers; Solderless Pressure Connectors:
1. Burndy; Part of Hubbell Electrical Systems.
 2. ILSCO.
 3. Thomas & Betts Corporation; a member of the ABB Group.
 4. Substitutions: Section 01 60 00 - Product Requirements.
- C. Manufacturers; Spring Wire Connectors:
1. 3M.
 2. NELCO, Inc.
 3. Substitutions: Section 01 60 00 - Product Requirements.
- D. Manufacturers; Compression Connectors:
1. 3M.
 2. NELCO, Inc.
 3. Substitutions: Section 01 60 00 - Product Requirements.

2.3 TERMINATIONS

- A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

- B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

2.4 CABLES

- A. Manufacturers
 - 1. USA WIRE
 - 2. Okonte
 - 3. Southwire
 - 4. Substitutions allowed

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify interior of building has been protected from weather.
- C. Verify mechanical work likely to damage wire and cable has been completed.
- D. Verify raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- D. Special Techniques--Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
 - 2. Install building wire 4 AWG and larger with pulling equipment.
- E. Special Techniques - Cable:
 - 1. Protect exposed cable from damage.
 - 2. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure. Do not rest cable on ceiling panels.
 - 3. Use suitable cable fittings and connectors.
- F. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors.
 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- G. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- I. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
- J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

- A. General:
1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
 - a. Black and red for single phase circuits at 120/240 volts.
 - b. Black, red, and blue for circuits at 120/208 or 240 volts single or three phase wye.
 - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
 2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
 - a. Black and red for single phase circuits at 120/240 volts.
 - b. Black, red, and blue for circuits at 120/208 volts single or three phase wye.
 - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number. White or Gray where there are two separate voltage systems. Add alternating stripe if three of four systems present. Intent is to provide unique neutral for each
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
 - 1. For 6 AWG and smaller: Green.
 - 2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rod electrodes.
 - 2. Active electrodes.
 - 3. Wire.
 - 4. Grounding well components.
 - 5. Mechanical connectors.
 - 6. Exothermic connections.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.
- B. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

- A. Grounding systems use the following elements as grounding electrodes:
 - 1. Metal building frame if used.
 - 2. Two ground rods at the service pole and at each wellhouse. Add ground rods as required to obtain resistance as required as per 1.4.A.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on grounding electrodes and connections.
- C. Manufacturer's Installation Instructions: Submit for active electrodes.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.
- B. Perform Work in accordance with NEC.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
- D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.9 COORDINATION

- A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. ERICO International Corporation.
 - 2. Harger Lightning & Grounding.
 - 3. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description:

1. Material: Copper-clad steel.
 2. Diameter: 3/4 inch.
 3. Length: 10 feet.
- C. Connector: Connector for exothermic welded connection.

2.2 WIRE

- A. Material: Stranded annealed copper ground wire.
- B. Foundation Electrodes: 4 AWG
- C. Grounding Electrode Conductor: Copper conductor insulated.
- D. Bonding Conductor: Copper conductor insulated.

2.3 MECHANICAL CONNECTORS

- A. Manufacturers:
1. Burndy; Part of Hubbell Electrical Systems.
 2. ERICO International Corporation.
 3. ILSCO
 4. Substitutions: Section 01 60 00 – Product Requirements.
- B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
1. Burndy; Part of Hubbell Electrical Systems.
 2. ERICO International Corporation.
 3. ILSCO
 4. Substitutions: Section 01 60 00 – Product Requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

- A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 INSTALLATION

- A. Install in accordance with IEEE 142 for power and IEEE 1100 for instrumentation.
- B. Install rod electrodes at locations as indicated on Drawings. If not shown, provided outside drip area and not less than 10 feet apart. Install additional rod electrodes to achieve specified resistance to ground.
- C. Install grounding and bonding conductors concealed from view.
- D. Install 4 AWG bare copper wire in foundation footing.
- E. Bond together metal siding not attached to grounded structure; bond to ground.
- F. Bond together each metallic raceway, pipe, duct and other metal object entering non-metallic enclosures including hatches cranes and lifting appurtenances.
- G. Install isolated grounding conductor for circuits supplying Instrumentation in accordance with IEEE 1100.
- H. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- I. Install continuous grounding by means of driven rods.
- J. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- K. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.
- L. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.
- M. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.
- N. Permanently attach equipment and grounding conductors prior to energizing equipment.
- O. Provide grounding bushings on all conduits entering non-metallic enclosures.

3.4 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground resistance testing in accordance with IEEE 142.
- E. Perform leakage current tests in accordance with NFPA 99.
- F. Perform continuity testing in accordance with IEEE 142.
- G. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conduit supports.
 - 2. Formed steel channel.
 - 3. Spring steel clips.
 - 4. Sleeves.
 - 5. Mechanical sleeve seals.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 - 4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- B. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- C. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
- D. Underwriters Laboratories Inc.:
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 - 3. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
 - 4. UL - Fire Resistance Directory.
- E. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- E. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Manufacturers:
 - 1. Adalet.
 - 2. Carlon Electrical Products.
 - 3. ERICO International Corporation.
 - 4. Minerallac Company.
 - 5. MIRO Industries, Inc.
 - 6. Thomas & Betts Corporation; a member of the ABB Group.
 - 7. Unistrut; an Atkore International company.
- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. ERICO International Corporation.
 - 3. Thomas & Betts Corporation; a member of the ABB Group.
 - 4. Unistrut; an Atkore International company.
- B. Substitutions: Section 01 60 00 – Product Requirements.

2.3 SPRING STEEL CLIPS

- A. Manufacturers:
 - 1. Adalet.
 - 2. ERICO International Corporation.
 - 3. Thomas & Betts Corporation; a member of the ABB Group.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.

3.2 PREPARATION

- A. Obtain permission from Engineer before using powder-actuated anchors.
- B. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide, expansion anchors, powder actuated anchors.
 - 2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 - 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
 6. Sheet Metal: Provide sheet metal screws.
 7. Wood Elements: Provide wood screws.
- B. Inserts:
1. Install inserts for placement in concrete forms.
 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below (where accessible) and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- C. Install conduit and raceway support and spacing in accordance with NEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.4 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- B. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.5 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.

- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install stainless steel escutcheons at finished surfaces.

3.6 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

3.7 CLEANING

- A. Section 01 70 00 - Execution Requirements: Requirements for cleaning.

3.8 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and hand holes.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.
 - 2. Section 26 05 03 - Equipment Wiring Connections.
 - 3. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 4. Section 26 05 29 - Hangers and Supports for Electrical Systems.
 - 5. Section 26 05 53 - Identification for Electrical Systems.
 - 6. Section 26 27 16 - Electrical Cabinets and Enclosures.
 - 7. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 1/2 inch unless otherwise specified.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
 - 1. Flexible metal conduit.
 - 2. Liquidtight flexible metal conduit.
 - 3. Nonmetallic conduit.
 - 4. Flexible nonmetallic conduit.
 - 5. Nonmetallic tubing.
 - 6. Raceway fittings.
 - 7. Conduit bodies.
 - 8. Surface raceway.
 - 9. Wireway.
 - 10. Pull and junction boxes.
 - 11. Hand holes.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents:
 - 1. Record actual routing of conduits larger than 2 inch.
 - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.7 COORDINATION

- A. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.
- B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube & Conduit.
 - 2. EGS/Appleton Electric.
 - 3. Republic Conduit.
 - 4. Thomas & Betts Corporation; a member of the ABB Group.
 - 5. Western Tube and Conduit Corporation.
 - 6. Wheatland Tube Company.
 - 7. Substitutions: Section 01 60 00 – Product Requirements.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.2 PVC COATED METAL CONDUIT

- A. Manufacturers:
 - 1. Robroy Industries.
 - 2. Thomas & Betts Corporation; a member of the ABB Group.
 - 3. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil thick.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Southwire Company.
 - 4. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description: Interlocked aluminum construction.
- C. Fittings: NEMA FB 1.
 - 1. Insulated throat Connectors

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Anamet Electrical, Inc.
 - 2. Carlon Electrical Products.
 - 3. EGS/Appleton Electric.
 - 4. Southwire Company
 - 5. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description: Interlocked aluminum construction with PVC jacket.
- C. Fittings: NEMA FB 1.
 - 1. Insulated throat connectors

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Emerson Process Management.
 - 3. Republic Conduit.
 - 4. Western Tube and Conduit Corporation.
 - 5. Wheatland Tube Company.
 - 6. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression type.
 - 1. Insulated throat connectors.
- D. Set screw or indenter type fittings and conduit bodies not permitted.

2.6 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. EGS/Appleton Electric.
 - 3. Hubbell Premise Wiring.
 - 4. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description: NEMA TC 2; Schedule 40 or 80 PVC as indicated on plans. If not indicated then SCH 80 is to be used.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.7 NONMETALLIC TUBING

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Premise Wiring.
 - 3. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description: NEMA TC 2.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.8 SEAL OFF FITTINGS HAZARDOUS LOCATION

- A. Manufacturers
 - 1. Crouse Hinds
 - 2. Killark
 - 3. Substitutions: Section 01 60 00 – Product Requirements.

2.9 WIREWAY

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 3. Hammond Mfg. Co. Inc.
 - 4. Hoffman; a brand of Pentair Equipment Protection.
 - 5. Panduit Corp.
 - 6. Square D; by Schneider Electric.
 - 7. Wiremold / Legrand.
 - 8. Substitutions: Section 01 60 00 – Product Requirements.
- B. Product Description: Oil-tight and dust-tight type wireway.
- C. Knockouts: Manufacturer's standard.
- D. Size and length as indicated on Drawings. If not shown, provide 6x6 wireway, length as required.
- E. Cover: Hinged cover with full gaskets.
- F. Connector: Flanged.
- G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
- H. Finish: Rust inhibiting primer coating with gray enamel finish.

2.10 OUTLET BOXES

- A. Manufacturers:
 - 1. Allied Moulded Products, Inc.
 - 2. Carlon Electrical Products.
 - 3. Emerson Electric Co.
 - 4. RACO; Hubbell.
 - 5. Substitutions: Section 01 60 00 – Product Requirements.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
- C. Nonmetallic Outlet Boxes: NEMA OS 2.
- D. Cast Boxes: NEMA FB 1, Type FD, cast fer alloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- E. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.11 PULL AND JUNCTION BOXES

- A. Manufacturers:
 - 1. Emerson Process Management.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Kraloy.
 - 4. RACO; Hubbell.
 - 5. Substitutions: Section 01 60 00 – Product Requirements.
- B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- C. Hinged Enclosures: As specified in Section 26 27 16.
- D. Surface Mounted Cast Metal Box: NEMA 250, Type 4X; flat-flanged, surface mounted junction box:
 - 1. Material: Galvanized cast iron.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.
- E. Provide seal off fittings as shown on plans and/or as required by code. Do not apply compound until after initial commissioning has been successfully completed unless sewage is present.
- F. Raceway and boxes located as indicated on Drawings, and at other locations as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway and boxes to complete wiring system.
- G. Underground More than 5 feet outside Foundation Wall: Provide plastic coated rigid steel conduit. Provide cast metal boxes or nonmetallic hand hole.
- H. Underground within 5 feet from Foundation Wall: Provide plastic coated conduit. Provide cast metal or nonmetallic boxes.
- I. In or Under Slab on Grade: Provide rigid steel conduit, intermediate metal conduit. Provide cast or metal boxes.
- J. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.
- K. In Slab Above Grade: Provide rigid steel conduit, intermediate metal conduit. Provide cast boxes.
- L. Wet and Damp Locations: Provide rigid steel conduit, intermediate metal conduit, electrical metallic tubing. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas. In hazardous classified locations provide only those listed materials allowed by code.
- M. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes with access. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- N. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- O. Chemical Rooms: Provide nonmetallic conduit, boxes, and fittings.

3.3 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit in and under slab from point-to-point.
- K. Maintain clearance between raceway and piping for maintenance purposes.
- L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- M. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.
- R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- S. Install fittings to accommodate expansion and deflection where raceway crosses, control and expansion joints.
- T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

- U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Close ends and unused openings in wireway.

3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings (notes or elevations) unless specified in section for outlet device.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- G. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- H. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- J. Install adjustable steel channel fasteners for hung ceiling outlet box.
- K. Do not fasten boxes to ceiling support wires or other piping systems.
- L. Support boxes independently of conduit.
- M. Install gang box where more than one device is mounted together. Do not use sectional box.
- N. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

- A. Section 01 70 00 - Execution Requirements: Testing, adjusting, and balancing.

- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Section 01 70 00 - Execution Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section expands and further defines identification requirements for electrical systems.
- B. Section Includes:
 - 1. Nameplates.
 - 2. Labels.
 - 3. Wire markers.
 - 4. Conduit markers.
 - 5. Stencils.
 - 6. Underground Warning Tape.
 - 7. Lockout Devices.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data:
 - 1. Submit manufacturer's catalog literature for each product required.
 - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
- C. Samples:
 - 1. Submit two samples of each type of identification products applicable to project.
 - 2. Submit two nameplates, 4 x 4 inch in size illustrating materials and engraving quality.
- D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NEC.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Requirements for storing products on site.
- B. Install labels or nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 WIRE MARKERS

- A. Manufacturers:
 - 1. Brady ID.
 - 2. Grafoplast Wire Markers.
 - 3. Ideal Industries, Inc.
 - 4. 3M Skotchcode.
 - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Description: Cloth tape, split sleeve, or tubing type wire markers.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
 - 2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams shop drawings.

2.2 CONDUIT AND RACEWAY MARKERS

- A. Manufacturers:
 - 1. Brady ID.
 - 2. Ideal Industries, Inc.
 - 3. Seton Identification Products.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.

- B. Description: Nameplate fastened with straps Labels fastened with adhesive.
- C. Color:
 - 1. Medium Voltage System: Black lettering on white background.
 - 2. 480 Volt System: Black lettering on white background.
 - 3. 208 Volt System: Black lettering on white background.
- D. Legend:
 - 1. Medium Voltage System: HIGH VOLTAGE.
 - 2. 480 Volt System: 480 VOLTS.
 - 3. 208 Volt System: 208 VOLTS.
 - 4. 240 System: 240 volts.
 - 5. Controls: DATA/CONTROL
- E. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
 - 2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

2.3 LOCKOUT DEVICES

- A. Lockout Hasps:
 - 1. Manufacturers:
 - a. Brady ID.
 - b. Master Lock Company, LLC.
 - c. Section 01 60 00 - Product Requirements
 - 2. Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section.
- B. Install identification on unmarked existing equipment.
- C. Replace lost nameplates.
- D. Re-stencil existing equipment.

3.3 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
 - 1. Install nameplate parallel to equipment lines.
 - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
 - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners or adhesive.
 - 4. Secure nameplate to equipment front using screws or adhesive.
 - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
 - 6. Install nameplates for the following:
 - a. Switchboards.
 - b. Panelboards.
 - c. Transformers.
 - d. Service Disconnects.
 - e. Control Panels.
 - f. Disconnects
- C. Label Installation:
 - 1. Install label parallel to equipment lines.
 - 2. Install label for identification of individual control device stations, and disconnects.
 - 3. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
 - 1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes each load connection.
 - 2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
 - 3. Install labels at data outlets identifying panel and termination designation per approved shop drawings or as indicated on Drawings.
- E. Conduit Marker Installation:
 - 1. Install conduit marker for each conduit longer than 6 feet.
 - 2. Conduit Marker Spacing: 20 feet on center.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL AND CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The requirements of this section apply to all sections of Divisions 26 and 40.
- B. This project will have selected building systems commissioned.
 - 1. Electrical and Control System commissioning description.
 - 2. Electrical and Control System commissioning responsibilities.
- C. Related Sections:
 - 1. Section 01 91 00 – Commissioning.
 - 2. Section 11 05 00 – Common Work Results & Commissioning for Equipment.
 - 3. Division 26 – Electrical.
 - 4. Division 40 – Process Controls and Instrumentation

1.2 REFERENCES

- A. National Electrical Testing Agency.
- B. Commissioning Authority – Contractor will contract the Commissioning Authority. Refer to Specification Section 01 91 00.

1.3 COMMISSIONED SYSTEMS

- A. Commissioning of a system or systems specified in Division 26 and Division 40 is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's Operation and Maintenance personnel in Division 26 and Division 40, is required.
- B. The Facility electrical systems commissioning will include the systems listed below:
 - 1. Panels
 - 2. All pump and motor controls
- C. Electrical and Controls Systems commissioning process includes the following tasks:
 - 1. Testing and startup of Electrical and Control equipment and systems.
 - 2. Equipment and system verification checks.
 - 3. Assistance in functional performance testing to verify testing and equipment and system performance.
 - 4. Provide qualified personnel to assist in commissioning tests.

5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
 6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
 7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
 8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
 9. Provide training for systems specified in this Section with coordination by Commissioning Authority.
- D. Equipment and Systems to Be Commissioned:
1. New Electrical and Control systems that were installed under this Contract.
- E. The following is a partial list of equipment that may be included in this Commissioning:
1. Pump Controls and Alarms
 2. All Instrumentation

1.4 COMMISSIONING SUBMITTALS

- A. Draft Forms: Submit draft of system verification form and functional performance test checklist.
- B. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified.
- C. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
- C. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NETA requirements.
- B. Maintain one copy of each document on site.

1.7 COMMISSIONING RESPONSIBILITIES

A. Equipment or System Installer Commissioning Responsibilities:

1. Attend commissioning meetings.
2. Ensure controls installer performs assigned commissioning responsibilities as specified below.
3. Ensure calibration agency performs assigned commissioning responsibilities as specified.
4. Provide instructions and demonstrations for Owner's personnel.
5. Ensure subcontractors perform assigned commissioning responsibilities.
6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
7. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for equipment and systems to be commissioned.
8. During verification check and startup process, execute process related portions of checklists for equipment and systems to be commissioned.
9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
10. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.
13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
15. Provide factory supervised startup services for equipment and systems specified in Division 26 and 40. Coordinate work with manufacturer and Commissioning Authority.
16. Perform verification checks and startup on equipment and systems as specified.
17. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
18. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
19. Conduct process system orientation and inspection.

B. Controls Installer Commissioning Responsibilities:

1. Attend commissioning meetings.
 2. Review design for ability of systems to be controlled including the following:
 - a. Confirm proper hardware requirements exist to perform functional performance testing.
 - b. Confirm proper safeties and interlocks are included in design.
 - c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
 - d. Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
 - e. Confirm sensors selected are within device ranges.
 - f. Review sequences of operation and obtain clarification from Architect/Engineer.
 - g. Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
 3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other Electrical and Controls sections.
 4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
 5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
 6. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements of Divisions 26 and 40.
 7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
 8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
 9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
 10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.
- C. Testing, Adjusting, and Calibration Agency Commissioning Responsibilities:
1. Attend commissioning meetings.
 2. Participate in verification of testing, adjusting, and calibration report for verification or diagnostic purposes.
 3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.8 COMMISSIONING MEETINGS

- A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.9 COORDINATION

- A. Notify Commissioning Authority minimum of four weeks in advance of the following:
 - 1. Scheduled equipment and system startups.
 - 2. Scheduled automatic temperature control system checkout.
 - 3. Scheduled start of testing, adjusting, and calibration work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

- A. Commissioning of Electrical systems will require inspection of individual elements of the electrical systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with the Commissioning plan to schedule electrical systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing.
- B. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the Owner and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists.
- C. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review.
- D. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission.

3.3 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 26 and 40 shall be scheduled and documented in accordance with Division 01. All testing shall be incorporated into the project schedule. Contractor shall provide no less than seven (7) calendar days of notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the

Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed.

3.5 TRAINING OF OWNER'S PERSONNEL

- A. Training of the operation and maintenance personnel is required. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes to the Engineer in accordance with the requirements of the Contract Documents. The instruction shall be scheduled in coordination with the Engineer after submission and approval of formal training plans. Documentation of attendance record shall be collected during training of Owner's personal. Refer to Division 01 and Division 26 Sections for additional Contractor training requirements.

END OF SECTION

SECTION 26 24 16

PANEL BOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution and branch circuit panelboards.
 - 2. Electronic grade branch circuit panelboards.
 - 3. Load centers.
- B. Related Requirements:
 - 1. Section 26 00 00 - Electrical Work, General.
 - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 3. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCE STANDARDS

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association:
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 5. NEMA PB 1 - Panelboards.
 - 6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
- E. Underwriters Laboratories Inc.:
 - 1. UL 50 - Cabinets and Boxes

2. UL 67 - Safety for Panelboards.
3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
4. UL 1283 - Electromagnetic Interference Filters.
5. UL 1449 - Transient Voltage Surge Suppressors.
6. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

- A. Section 26 00 00 - Electrical Work, General.
- B. Section 01 33 00 - Submittal Procedure.
- C. Product Data: Submit catalog data showing specified features of standard products.
- D. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- E. Source Quality control submittals: Indicate results of factory tests and inspections.
- F. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Extra Stock Materials:
 1. Furnish two of each panelboard key. Panelboards keyed alike.

1.6 QUALITY ASSURANCE

- A. Qualifications
 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Manufacturers
 - 1. Square D
 - 2. General Electric
 - 3. Eaton
 - 4. Cutler Hammer
 - 5. Substitutions: Section 01 60 00 – Substitution Requirements
- B. Description: NEMA PB 1, circuit breaker type panelboard.
- C. Operation
 - 1. Service Conditions:
 - a. Temperature: 50-80 degrees F
 - b. Altitude: 100 feet above sea level.
 - 2. Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 120/240 volt panelboards or as indicated on Drawings.
- D. Materials
 - 1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
 - 2. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
 - a. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 - b. Furnish circuit breakers UL listed as Type GFCI Class B for Electric Heat Trace
 - 3. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated on Drawings.
 - 4. Enclosure: NEMA PB 1, Type 12 Minimum or as shown on Drawings.
- E. Finishes
 - 1. Manufacturer's standard gray enamel for NEMA 12
 - 2. Stainless Steel or Aluminum for NEMA 4 or 4X

2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards plumb.
- C. Install recessed panelboards flush with wall finishes.
- D. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- E. Install filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.
- G. Install engraved plastic nameplates in accordance with Section 26 05 53.
- H. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.
- D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

3.3 ADJUSTING

- A. Section 01 70 00 - Execution Requirements: Requirements for starting and adjusting.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 10 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 CLEANING

- A. Section 01 70 00 - Execution Requirements: Requirements for cleaning.
- B. Clean existing panelboards to remain or to be reinstalled.

END OF SECTION

SECTION 26 27 16 ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinged cover enclosures.
2. Cabinets.
3. Terminal blocks.
4. Accessories.

B. Related Requirements:

1. Section 26 00 00 - Electrical Work, General.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.

C. Manufacturer's Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials:

1. Furnish two of each key.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Manufacturers:

1. Adalet.
2. Carlon Electrical Products.
3. Hoffman; a brand of Pentair Equipment Protection.
4. Leviton Manufacturing Co., Inc.
5. Wiegmann; Hubbell Inc.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Description: NEMA 250, Type NEMA 12 steel enclosure.

1. Covers: Continuous hinge, held closed by flush latch operable by screwdriver.
2. Furnish interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
3. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

A. Manufacturers:

1. Hammond Mfg. Co. Inc.
2. Hoffman; a brand of Pentair Equipment Protection
3. Substitutions: Section 01 60 00 - Product Requirements.

B. Description:

1. Boxes: Galvanized steel.
2. Box Size: As required.
3. Backboard: Paint matte white.
4. Fronts: Steel, surface type with screw cover front door with concealed hinge, and flush lock.
5. Knockouts: None.

C. Fabrication

1. Furnish metal barriers to form separate compartments wiring of different systems and voltages.
2. Furnish accessory feet for free-standing equipment.

D. Finishes:

1. Finish with gray baked enamel.

2.3 TERMINAL BLOCKS

A. Manufacturers:

1. Allen-Bradley/Rockwell Automation.
2. Cooper Bussmann; a division of Cooper Industries.
3. Square D; by Schneider Electric.
4. Entrelec,
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Description:

1. Terminal Blocks: NEMA ICS 4.
2. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
3. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
4. Furnish ground bus terminal block, with each connector bonded to enclosure.

2.4 PLASTIC RACEWAY

A. Manufacturers:

1. Panduit Corp.
2. Wiremold / Legrand..
3. Substitutions: Section 01 60 00 - Product Requirements.

B. Description: Plastic channel with hinged or snap-on cover.

2.5 CORROSION PROTECTION

A. Manufacturers; Emitter:

1. Cortec Corporation.
2. Substitutions: Section 01 60 00 - Product Requirements.
3. Description: Foam emitter to provide long term protection against corrosion by airborne contaminants.
 - a. For each enclosure, furnish quantity as indicated in manufacturer's instructions to protect the enclosure.

B. Manufacturers; Absorber:

1. Cortec Corporation.
2. Substitutions: Section 01 60 00 - Product Requirements.
3. Description: Plastic cup with breathable membrane to absorb corrosive gasses from the enclosure.
 - a. For each enclosure, furnish quantity as indicated in manufacturer's instructions to protect the enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29.
- B. Install cabinet fronts plumb.

3.2 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean existing cabinets and enclosures to remain or to be reinstalled.
- C. Clean electrical parts to remove conductive and harmful materials.
- D. Remove dirt and debris from enclosure.
- E. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wall switches; wall dimmers; receptacles; multi-outlet assembly; and device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

1.5 EXTRA MATERIALS

- A. Section 01 70 00 - Execution Requirements: Spare parts and maintenance products.
- B. Furnish two of each style, size, and finish wall plate.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices shall carry the UL label.
- B. General purpose duplex receptacles and toggle switch handles shall be brown everywhere except in finished rooms where they shall be ivory. Special purpose receptacles shall have a body color as indicated. Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively.

2.2 MECHANICAL TIMERS

- A. As shown on plans.

2.3 LIGHTING SWITCHES

- A. Local branch switches shall be toggle type, rated at 20 amps, 120-277 VAC, and shall be **General Electric Cat. No. GE-5951-1** for single pole, **GE-5953-1** for 3-way and **GE-5954-1** for 4-way, or similar types as manufactured by **Hubbell**, or equal

2.4 GENERAL PURPOSE RECEPTACLES

- A. Duplex receptacles rated 120-volt, 20 amps shall be polarized 3-wire type for use with 3-wire cord with grounded lead and 1 designated stud shall be permanently grounded to the conduit system (NEMA 5-20R). Duplex 120-volt receptacles shall be **G.E. 5362, Hubbell 5362**, or equal. Single receptacles shall be **G.E. 4102, Hubbell 4102**, or equal.
- B. Ground-fault circuit interrupting receptacles (GFCI's) shall be installed at the locations indicated. GFCI's shall be rated 125-volt, 20 amps and shall be **Hubbell GF-5362**, or equal.

2.5 ENCLOSURES AND COVERS

- A. Surface mounted switches and receptacles shall be in FS or FD type cast device boxes.
- B. In finished areas, switch and receptacle boxes shall be provided with SUPER STAINLESS STEEL COVERS as manufactured by **Harvey Hubbell, Arrow Hart, Bryant**, or equal.
- C. In areas where cast boxes are used, switch and receptacle covers shall be **Crouse-Hinds Catalogue No. DS185 and WLRD-1, or Adalet No. WSL and WRD**, or equal.
- D. Receptacles in exterior locations and where used with chemical dosing pumps shall be with s-hinged cover/enclosure marked "Suitable for Wet Locations when in use" and "UL Listed." There shall be a gasket between the enclosure and the mounting surface and between the hinged cover and mounting plate/base. The cover shall be **TayMac Specification Grade**, or equal.

2.6 NAMEPLATES

- A. Provide nameplates or equivalent markings on switch enclosures to indicate ON and OFF positions of each switch. ON and OFF for 3-way or 4-way switches is not acceptable. Provide receptacles for special purposes with nameplates indicating their use. Conform to requirements of Section 26 00 00 – Electrical Work, General.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.
- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Install receptacles with grounding pole on top.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- G. Install wall plates on flush mounted switches, receptacles, and blank outlets.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
- J. Use jumbo size plates for outlets installed in masonry walls.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified and as indicated on drawings.
- B. Install wall switch 48 inches above finished floor.
- C. Install convenience receptacle 24 inches above finished floor.
- D. Install convenience receptacle 6 inches above counter back splash of counter.
- E. Install dimmer 48 inches above finished floor.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, and 01 70 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Section 01 70 00 - Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

- A. Section 01 70 00 - Execution Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 26 ENCLOSED TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes transfer switches in individual enclosures.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.
 - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
 - 4. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.
- B. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. Underwriters Laboratories Inc.:
 - 1. UL 1008 - Transfer Switch Equipment.

1.3 SCOPE

- A. Provide Manual Transfer.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of enclosed transfer switches.
- C. Operation and Maintenance Data: Submit routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Supplier: Authorized distributor of specified manufacturer with minimum three years experience.

1.7 MAINTENANCE SERVICE

- A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of transfer switches for one year from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUAL TRANSFER SWITCH

- A. Manufacturers:
 - 1. Square D
 - 2. Siemens
 - 3. Cutler Hammer.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: manual transfer switch suitable for use as service equipment.
- C. Configuration: Manually operated transfer switch.
- D. Rating: As indicated on drawings.
- E. Interrupting Capacity: 100% of rating.

F. Service Conditions:.

1. Temperature: -60-90 degrees F.
2. Altitude: 100 feet above sea level.

G. Product Features:

1. Enclosure:
2. Enclosure: ICS 10, Type 4X.
3. Finish: Stainless Steel.

2.2 SOURCE QUALITY CONTROL

- A. Listing for use as intended.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install engraved plastic nameplates for UTILITY/OFF/STANDBY in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.22.3.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Section 01 40 00 - Quality Requirements: Manufacturers' field services.
- B. Check out transfer switch connections and operations and place in service.

3.4 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

3.5 DEMONSTRATION AND TRAINING

- A. Demonstrate operation of transfer switch in normal, and emergency modes.

END OF SECTION

SECTION 26 29 13
ENCLOSED CONTROLLER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Manual motor starters.
- B. Magnetic motor starters.
- C. Combination magnetic motor starters.
- D. Disconnect Switches.
- E. Fuses

1.2 RELATED WORK

- A. Division 22 – Plumbing
- B. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)
- C. Section 26 05 29 – Hangers and Supports for Electrical Systems
- D. Section 26 05 53 – Identification for Electrical Systems
- E. Section 26 00 00 - Electrical Work, General.

1.3 REFERENCES

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.
- B. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- C. NEMA AB 1 - Molded Case Circuit Breakers.
- D. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- E. NEMA KS 1 - Enclosed Switches.
- F. NEMA PB 1 - Panelboards.
- G. NEMA PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 01.

- B. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.
- D. Submit manufacturers' instructions under provisions of Division 01.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products to site under provisions of Division 01.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

1.7 SPARE PARTS

- A. Keys: Furnish 2 each to Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS

- A. Square D.
- B. Allen Bradley.
- C. Siemens.
- D. Cutler Hammer.
- E. Substitutions: Under provisions of Division 01.

2.2 MANUAL MOTOR STARTERS

- A. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, number of poles as required by the load served, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
- B. Enclosure: ANSI/NEMA ICS 6; Type 1 or 3R, as indicated on the Drawings.

2.3 MAGNETIC MOTOR STARTERS

- A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Full Voltage Starting: Non-reversing type.
- C. Coil Operating Voltage: 120 volts, 60 Hertz.
- D. Size: NEMA ICS 2; size as required by the load served.
- E. Overload Relay: NEMA ICS 2; solid state, with 3 to 1 adjustment for trip current and phase loss and unbalance protection.
- F. Enclosure: NEMA ICS 6; Type 1 or 3R as shown on the drawings.
- G. Combination Motor Starters: Combine motor starters with motor circuit protector disconnect in common enclosure.
- H. Auxiliary Contacts: NEMA ICS 2; two field convertible contacts in addition to seal-in contact.
- I. Indicating Lights: NEMA ICS 2; RUN: red LED light in front cover.
- J. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.
- K. Control Power Transformers: 120 volt secondary, VA capacity as required by the load served in each motor starter.
- L. Power Monitor: Include a three-phase power monitor in each magnetic starter connected to shut down the motor on loss of any phase, phase reversal, or low voltage on any phase. Power monitor shall automatically reset and restart motor when phase and voltage conditions return to normal. Provide oversize starter enclosures as required to install power monitor.

2.4 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

- A. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.

2.5 FUSIBLE SWITCH ASSEMBLIES

- A. Description: NEMA KS 1, Type HD, enclosed load interrupter knife switch. Handle lockable in OFF position.
- B. Operation:
 - 1. Switch Ratings
 - a. Switch Rating: select disconnect based on circuit ampacity, horsepower and voltage as required by the application.

- b. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes).
- C. Materials:
 - 1. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
 - 2. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - a. Interior Dry Locations: Type 1.
 - b. Exterior Locations: Type 3R.
 - 3. Furnish switches with entirely copper current carrying parts.

2.6 NONFUSIBLE SWITCH ASSEMBLIES

- A. Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.
- B. Operation:
 - 1. Switch Ratings
 - a. Switch Rating: select disconnect based on circuit ampacity, horsepower and voltage as required by the application.
 - b. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes
- C. Materials:
 - 1. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - a. Interior Dry Locations: Type 1.
 - b. Exterior Locations: Type 3R.
 - 2. Furnish switches with entirely copper current carrying parts.

2.7 FUSES

- A. Dimensions and Performance: NEMA FU 1, Class as specified
 - 1. Other Feeder Switches Larger than 600 amperes: Class L.
 - 2. General Purpose Branch Circuits: Class RK1.
 - 3. C. Motor Branch Circuits: Class RK5.
- B. Voltage: Rating suitable for circuit phase-to-phase voltage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's instructions.
- B. Select and install heater elements in motor starters to match installed motor characteristics.

- C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
- D. After final connections are made, check and correct the rotation of all motors.
- E. Field adjust the trip settings of all motor starter magnetic trip only circuit breakers to approximately 11 times motor full load current. Determine full load current from motor nameplate following installation.
- F. Motor starting equipment shall be listed for use with the motors specified under Division 23.
- G. Enclosed Switches
 - 1. Install enclosed switches where indicated.
 - 2. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.
 - 3. Height: 5 feet to operating handle.
 - 4. Install fuses for fusible disconnect switches.
 - 5. Install fuse with label oriented so manufacturer, type, and size are easily read.
 - 6. Install engraved plastic nameplates in accordance with Section 26 05 53. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.

END OF SECTION

SECTION 26 29 23
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes variable frequency controllers. Integral (motor mounted) variable frequency controllers are specified with the associated motor.
- B. Provide variable frequency motor controllers where called out on plans (identified as “VFD-x”) or as required by the specifications for control panel mounted units.
 - 1. Provide HP rating as required by the motor served.
 - 2. Provide voltage rating as shown on one line drawings.
- C. This section covers all VFD’s provided in this project.
 - 1. Combination VFD units serving the Backwash Pump and Air Blower.
 - 2. VFD units serving pumps in wellhouses
- D. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 3. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.
 - 4. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- C. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- D. Test Reports: Indicate field test and inspection procedures and test results.
- E. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 7.1. Include procedures for starting and operating controllers, and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Procurement of drive must be made through appropriate vendors that service the installation location to avoid warranty issues.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for variable frequency controller.

1.9 MAINTENANCE SERVICE

- A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of variable frequency controller for one year from Date of Substantial Completion.

1.10 MAINTENANCE MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY CONTROLLER

- A. Manufacturers:
 - 1. Allen Bradley PowerFLEX 400 Series
 - 2. Substitutions: Not allowed – components selected to match existing equipment for compatibility for upgrade.
- B. Model:
 - 1. Wells 1, 4, 6 - 23C-X012E10ENNAANN-E5-LR
 - 2. Wells 3, 8 - 23C-X017E10ENNAANN-E5-LR
 - 3. Substitutions: Only allowed substitutions is other Powerflex 400 or 700 VFDs. VFD must have line reactor, have NEMA 4 enclosure, have a fused disconnect, and be able to function as required in the Operational Narrative.

- C. Product Description: NEMA ICS 7, enclosed variable frequency controller suitable for operating indicated loads
- D. Unit to include integral motor disconnecting means consisting of thermal magnetic circuit breaker and external lockable switched operator, integral line filters, panel mounted HMI controller and pre-terminated terminal blocks for remote alarm and control connections.
- E. RATINGS
 - 1. VOLTAGE CLASSES:
 - a. Displacement power factor is between 1.0 and 0.95, lagging, over the entire speed range.
 - b. The efficiency is a minimum of 97% at full load and speed.
- F. ENVIRONMENT:
 - 1. Storage ambient temperature range: -40° C to 70° C (-40° to 158°F).
 - 2. Operating ambient temperature range without derating:
 - a. IP00, Open Type 0° C to 50° C (0° to 122° F)
 - b. IP20, Type 1 0° C to 50° C (0° to 122° F)
 - c. Flange Mount (IP66/NEMA 4X/12 backside) 0° C to 50° C (0° to 122° F)
 - d. IP66, Type 4X/12 (indoor use) 0° C to 40° C (0° to 104° F)
 - 3. The relative humidity range is 5% to 95% non-condensing.
 - 4. Operating elevation: up to 1000 Meters (3,300ft) without derating.
 - 5. Shock: 15G peak for 11ms duration
 - 6. Vibration: 0.152 mm (0.006 inches) displacement, 1G peak
- G. REFLECTED WAVE
 - 1. A software algorithm to limit the reflected wave due to long cable lengths to a maximum of 2.25 times the bus voltage or 1600V, whichever is less, up to cable lengths of 600 ft (183m).
 - 2. Hardware designs also limit peak voltages on the motor.
- H. DESIGN HARDWARE:
 - 1. Employs the following power components
 - a. Diode or fully gated bridge on the input.
 - b. DC bus inductor on ratings 7.5HP (5.5kW) or greater.
 - c. Switching logic power supply operating from the DC bus.
 - d. MOV protection - phase to phase and phase to ground with jumpers to remove the phase to ground unit when applicable.
 - e. Common Mode Capacitors on all units above 2 HP, 480V with jumpers for removal when used on ungrounded systems
 - f. Gold plated plug-in connections on printed circuit boards.
 - g. Microprocessor based inverter logic isolated from power circuits.
 - h. Nominal IGBT rise time of 200ns or longer.
 - i. Inverter section has no commutation capacitors.

- j. The Main Control Board is the same for all ratings to optimize spare parts stocking and exchange.
- k. Common control connection for all ratings.
- l. Device Peripheral Interface (DPI) for connection to common options.
- m. Status LED for drive condition, viewable through the cover.
- n. Status LEDs for communications status, including embedded DPI status, adapter
- o. health and communications network status, viewable through the cover.

I. CONTROL LOGIC:

- 1. Programmable or self-adjusting for the following:
 - a. Operating the drive with motor disconnected.
 - b. Controlled shut down, when properly fused, with no component failure in the event of an output phase to phase or phase to ground short circuit and fault annunciation.
 - c. Advanced thermal manager to provide full protection of the power devices by reducing
 - d. PWM frequency, and output speed.
 - e. Adjustable PWM carrier frequency within a range of 2-12 kHz.
 - f. Selectable V/ Hz, Sensorless Vector, and Vector Control with Force Technology
 - g. Suitable for use on both Normal Duty and Heavy Duty loads.
 - h. Normal Duty ratings are:
 - 1) Rated Current continuously
 - 2) 110% Overload capability for up to 1 minute
 - 3) 150% Overload capability for up to 3 seconds
 - i. Heavy Duty ratings are:
 - 1) Rated Current continuously
 - 2) 150% Overload capability for up to 1 minute
 - 3) 200% Overload capability for up to 3 seconds
 - j. Multiple programmable stop modes including - Ramp, Coast, DC-Brake, and Ramp-to-Hold.
 - k. Multiple acceleration and deceleration rates.
 - l. All adjustments to be made with the door closed.
 - m. Protection for loss of an input phase
 - n. Adjustable output frequency up to 500Hz.

J. OPERATOR INTERFACE:

- 1. Display is a 7 line by 21 character backlit LCD display with graphics capability. It is used to display drive operating conditions, fault / alarm indications and programming information with full text support in English.
- 2. The monitoring mode provides the following information on the display all at the same time (doesn't require jumping between screens)
 - a. A status line indicating direction, status, fault / alarm conditions and Auto / Manual mode.
 - b. Three additional lines that may be programmed for at least 20 different quantities with custom text and scaling capability. This section is also configurable as a "screen saver"

with programmable timeout. When time expires, the LCD display automatically reverts to this display.

3. The Human Interface Module :
 - a. An IP66 / UL Type 4X-12 local drive mounted version used for stand alone
 - b. Full Numeric with control buttons:
 - 1) includes the following drive operating keys
 - a) Start,
 - b) Stop,
 - c) Direction,
 - d) Jog and
 - e) Speed Control
 - 2) programming keys,
 - 3) numeric keys for direct data entry, and
 - 4) ALT (alternate function) key used for quick access to common tasks. These ALT functions include S.M.A.R.T. Start for fast and easy commissioning,
 - 5) View selection,
 - 6) Auto Manual operation,
 - 7) And HIM removal under power, and device selection for programming:

K. ANALOG INPUTS

1. (1) differentially isolated 0 to 10V / 4 to 20mA input , 10 bit, 10V common mode voltage range
2. (1) differentially isolated bipolar -10 to +10V or 4-20 mA input, 10 bit plus sign, 160 V common mode voltage range.
3. All functions are programmable for a variety of uses including frequency command, process loop inputs and others. Inputs are also programmable for scaling (including invert), offset, signal loss detect and square root.
4. Analog input references are independently scaleable, both from the analog input side and from the speed reference side. A bi-polar analog signal (-10V to + 10V) may also be used to control direction.
5. Includes over speed protection in the event that the output frequency exceeds the maximum reference by a specified amount.
6. All reference signals may have a trim signal applied to them for finer resolution and accuracy. Trim source and amount is programmable.

L. LOSS OF REFERENCE:

1. Capable of sensing the following reference loss conditions;
 - a. 2-10V DC signals below 2 volts
 - b. 4-20ma signals below 4 ma
2. In the event of loss of an analog input reference signal, the following actions are programmable:
 - a. Fault the drive
 - b. Alarm and maintain last reference

- c. Alarm and go to preset speed
 - d. Alarm and go to minimum speed
 - e. Alarm and go to maximum speed
 - f. Alarm and maintain last output frequency
3. Signal loss detection is available regardless of the function of the analog input.

M. ANALOG OUTPUT

1. A single ended output capable of either 0 – 10 Vdc or 4 – 20mA is available as standard, and programmable for a wide variety of process parameters including output frequency, output current, output power and others. Programming is available to select either absolute or signed values of these parameters, in addition to offset and gain adjustments for matching signal requirements such as 2 – 10V DC.

N. REFERENCE SIGNALS:

1. Capable of the following speed reference signals:
- a. Digital MOP
 - b. Jog
 - c. HIM (Program/Control panel)
 - d. Analog Input signals
 - e. Preset Speeds (7)
 - f. 16 bit network reference
 - g. 32 bit network reference
 - h. Encoder (pulse) signal

O. DIGITAL INPUTS:

- 1. Six inputs are provided and are configurable as 24Vdc sink or source.
- 2. 115VAC control interface is available and fit under the cover of the drive.
- 3. All inputs are individually programmable for functions from a list of 29 or more, that include Start (3-wire control), Run (2-wire control), Stop, External fault, Speed select, Jog, Process PI functions, and others.
- 4. The state of these inputs can also be communicated over a network, whether the drive issuing them for control functions or not.
- 5. One of the digital inputs supports a dedicated enable input, which is configured by the removal of a jumper.
- 6. All other digital inputs do not require jumpers or switches for digital input configuration.
- 7. Inputs draw 11.2 mA minimum each @ 24 VDC and require 19.2 V minimum for “ON” state and a maximum of 3.2 V for “OFF” state

P. DIGITAL OUTPUTS:

- 1. Two Form C (1 N.O - 1 N.C) output relays.
- 2. Contact output ratings are 250VAC/ 220V DC, 50VA and 60W (resistive), 25VA and 25W (inductive).
- 3. Both relays are programmable for at least 26 different conditions including Fault, Alarm, At Speed, Drive Ready, PI Excess Error and others.

4. Each output has on-delay and off-delay timers relative to the function assigned to the input.
5. The inputs can also be controlled over network communications if they are not assigned to drive related functions.

Q. SAFETY INPUT:

1. One Safe – Off interface option is provided. This interface, when used along with the dedicated enable digital input, is TUV certified to EN954-1, category 3.

R. ENCODER FEEDBACK:

1. One incremental encoder interface option is provided. This option is selectable to receive either 5V or 12V from an encoder with a maximum of 250kHz.
2. The encoder interface also has the ability to power the encoder.
3. Minimum high state voltage is 3.5Vdc (5V mode) and 7.0Vdc (12V mode).
4. Maximum low state voltage is 1Vdc (for both 5V and 12V modes).

S. FEATURES

1. ACCELERATION/DECELERATION: Accel/Decel settings provide separate adjustments to allow either setting to be adjusted from 0.0 seconds to 3600.0 seconds. A second set of remotely selectable Accel/Decel settings are accessible through digital inputs. Programming capability allows the user to produce acc/dec profiles with linear or "S-Curve" characteristics that provide changing accel/decel rates. S-Curve profiles are adjustable.
2. AUTO ECONOMIZER: This feature automatically reduces the output voltage when the drive is operating at a stable speed and partial load. The voltage is reduced to minimize flux current in a lightly loaded motor thus reducing kW usage. If the load increases, the drive will automatically return to normal operation.
3. AUTO / MANUAL MODE: The Human Interface Module has the ability to switch between Auto (remote signals) and Manual (local control from the HIM buttons) for both speed reference and start control. Auto/ Manual transfer of either speed reference, start control, or both, are programmable. The feature is compatible with both two wire and three wire digital input run / start assignments. The user has the choice of preloading the HIM with the current "auto" frequency reference before transferring control to allow for smooth transitions.
4. AUTO RESTART: Provides up to nine automatic fault reset and restarts following a fault condition before locking out and requiring manual restart. The automatic mode is not applicable to a ground fault, shorted output faults and other internal microprocessor faults. The time between restarts is adjustable from 0.5 seconds to 30.0 seconds
5. BRAKING OPTIONS:
 - a. Dynamic Braking: A standard built in 7th IGBT for use as a dynamic braking chopper. This IGBT can provide at least 100% braking torque on a continuous basis. Drives up to 30 HP, 480V also have an optional drive mounted dynamic braking resistor for low duty cycle braking applications and interactive software to protect the resistor from abuse. If the resistor's duty cycle or power rating is exceeded, the drive software manages the operation of the 7th IGBT to bring the loading below the resistor's maximum level. If applications require additional braking, the 7th IGBT is capable of driving an externally mounted resistor that can provide 100% duty cycle.

- b. Flux Braking: An algorithm to provide additional braking power by eliminating additional regenerative energy as flux in the motor. This can be used during all decelerations including stopping.
 - c. Fast Braking: An algorithm to provide maximum braking power (during a stop command only) without the use of a DB resistor by maximizing slip in the motor.
6. BUS REGULATION:
- a. DC Bus regulation is available to reduce the possibility of overvoltage trips due to regenerative conditions. The reaction to a bus voltage increase is programmable as follows.
 - 1) Disabled: faults on Overvoltage Fault
 - 2) Adjust Frequency: adjusts the output frequency to maintain bus voltage at a predetermined regulation level.
 - 3) Dynamic Brake: dissipates the excess energy on the bus through the internal DB chopper and connected resistor.
 - a) Both – DB 1st begins by actuating the dynamic brake. If more response is needed, it will then adjust the output frequency.
 - b) Both – FRQ 1st begins by adjusting the output frequency. If more response is needed, it will then actuate the dynamic brake Alternating between two of the above modes during operation is accomplished through digital input functions.

T. COMMUNICATIONS

1. DPI™ Peripheral INTERFACE:

Provides an interface for up to 4 independent peripherals to be connected to the drive at one time. This protocol operates between 125K and 500k baud and allows for connection to other networks via third party suppliers. Connection and identification of DPI port addresses requires no user adjustments.

2. COMMUNICATIONS INTERFACE:

Capability for 1 internally mounted and 2 additional externally mounted communications interface cards. Internal cards use drive power and can operate at higher speeds. Externally mounted cards are separately powered and connected to the drive via a cable. The following is available as internal solutions:

- a. DeviceNet
- b. EtherNet IP
- c. ControlNet
- d. Coax
- e. ControlNet Fiber
- f. Remote I/O

U. ADDITIONAL FEATURES

1. CONTROL MODE: Programming provides the ability to select either V/ Hz, Sensorless Vector, or Vector Control with Force Technology. The sensorless vector and vector control modes use motor nameplate data plus motor operating data such as stator resistance, nominal flux current and flux up time to tune the motor / drive for optimum torque performance. The

volts per hertz mode can be programmed for constant torque, fan/pump curve, or full custom patterns.

2. **CURRENT LIMIT:** Programmable current limit up to 150% of drive rated amps. Current limit is active for all drive states; accelerating, constant speed and decelerating. Both the source of the current limit value and the gain for responsiveness adjustment are programmable. Employs PI regulation with an adjustable gain for smooth transition in and out of current limit.
3. **DRIVE OVERLOAD PROTECTION:** Provides overload protection that automatically adjusts PWM frequency, Current Limit, or both (programmable) in an attempt to provide tripless operation. Two different levels of accumulated overload can be signaled as alarm conditions, allowing the user to adjust a process to eliminate an overload trip. A parameter is available to directly read the level of accumulated overload.
4. **DROOP CONTROL:** This function reduces output frequency in response to load, allowing other drives to share the load. Function is adjustable in amount of RPM difference at full load.
5. **FAULT MEMORY:** The last four fault codes with respective times are stored in the fault buffer. In addition, information about the drive's condition at the time of the last fault such as operating frequency, output current, dc bus voltage and 27 other status conditions are stored at the time of fault. Information is maintained in the event of a power loss. A power up marker is also provided at each power up time to aid in analyzing fault data.
6. **FLUX UP:** This function prefluxes the motor for quicker starts in high cycle applications. The flux-up time can be manually adjusted or automatically calculated based on entered motor nameplate data.
7. **FLYING START:** Capable of determining the speed and direction of a spinning motor and matching the frequency and voltage, with or without the use of encoder feedback.
8. **INERTIA RIDE THROUGH:** Responds to a loss of AC input power by adjusting the output frequency to create a regenerative situation in the motor allowing the drive to retain control of the motor during a power outage. Performance is based on the amount of system inertia and the length of the outage.
9. **LOAD LOSS DETECTION:** Capable of detecting when the load has been reduced to a specified amount, which is adjustable. An alarm will occur when this condition is present, and a fault will occur when the condition exists for a specified amount of time, which is also adjustable. The detection is based on a torque measurement algorithm and not simply just total output current.
10. **MEMORY STORAGE:** Stores all settings in NVS (non-volatile storage) memory, which is retained while the drive is powered or unpowered. Three User Set locations are offered and can be chosen instantaneously (while the drive is stopped) through a single network command or by actuating the digital inputs when programmed for this function. The user sets can also be independently named.
11. **MOTOR OVERLOAD PROTECTION:** Provides UL listed Class 10 motor overload protection to comply with N.E.C. Article 430. Overload protection is speed sensitive and adjustable. To accommodate a variety of motors with different speed range capabilities, the frequency at which the overload begins to derate is programmable.
12. **PROCESS PID CONTROL:** The internal process PID regulator has proportional, integral, and derivative gain adjustments as well as error inversion, integrator preload, and anti-windup functions. Protection is provided for a loss of feedback or reference signal. A signal can also be provided to indicate that excess error exists.

13. RIDE THROUGH: Control logic is capable of "riding through" a power outage of at least 0.5 seconds induration. The inverter section is shut off after an 18% drop in bus voltage to conserve power for the drive logic.
14. SKIP FREQUENCIES: Three adjustable setpoints that lock out continuous operation at frequencies that may produce mechanical resonance are provided. The setpoints have a bandwidth adjustable from 0Hz to 60Hz.
15. SLEEP / WAKE MODE: Capability to use an analog input as a Start – Stop command. A signal below the sleep level acts as a Stop Command and a signal above the wake level acts as a Start Command. Sleep / Wake time and level are fully programmable and can be inverted.
16. SPEED REGULATION: Performs as follows in the Vector Control mode:
 - a. Open Loop: 120:1 operating range. 0.1% of base speed across 120:1 speed range
 - b. Closed Loop: 1000:1 operating range. 0.001% of base speed across 120:1 speed range.
17. START AT POWER UP: A user programmable restart function is provided to automatically restart the equipment after restoration of power after an outage. A run or start input is required for this function.

2.2 SOURCE QUALITY CONTROL

- A. Shop inspect and perform standard productions tests for each controller and submit results.

2.3 STAND-ALONE UNITS

- A. VFD's shown for stand alone (not part of a control panel) operation shall be part of a self-contained combination assembly.
- B. The following options shall be included as specified in the document:
 1. All options shall be factory mounted and wired and comply with same codes and standards as drive specified above.
 2. Input thermal magnetic circuit breaker.
 3. Door-Interlocked Main Input Disconnect shall mount within NEMA 12 enclosure for positive power disconnect of the VFD. It shall have the capability for door padlocking.
 4. A three position Hand/Off/Auto switch on the bypass operator interface shall allow the user to:
 - a. Transfer the control source (Start/Stop) to the drive keypad in Hand mode.
 - b. Stop the motor in Off mode.
 - c. Transfer the control source (Start/Stop and speed setpoint) to the drive's terminal block in Auto mode.
 5. The operator interface on the bypass option box shall the following indicating LEDs:
 - a. Ready (green)
 - b. Drive output enable (green)

C. CONTROL INTERFACE

1. Provide terminal blocks for analog (4-20mA) and digital (ON-OFF) remote inputs.
2. Provide pre-programmed units that will allow remote setpoint speed control and ON-OFF operation.
3. Specific motor information to be provided by contractor (motors are existing).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify building environment is maintained within service conditions required by manufacturer.

3.2 EXISTING WORK

- A. Disconnect and remove existing controllers.
- B. Download existing operating parameters (PID, setpoints, ramp up timing, etc) for re-use in new controller setup
- C. Clean and repair existing controllers and return to owner.

3.3 INSTALLATION

- A. Install in accordance with NEMA ICS 7.1.
- B. Where installed in control panels provide cooling were required based on a 68F nominal ambient temperature.
- C. Where not installed within a control panel, provide VFD assemblies with circuit breaker disconnect as a unit package: Allen Bradley Pump and Fan unit or equal.
- D. Tighten accessible connections and mechanical fasteners after placing controller.
- E. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- F. Install engraved plastic nameplates in accordance with Section 26 05 53.
- G. Neatly type label inside controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

- H. Ground and bond controller in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 7.1.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Section 01 40 00 - Quality Requirements: Manufacturer's field services.
- B. Provide all programming and interface integration to permit operation per process narrative.
- C. Prepare and start up variable frequency controller.

3.6 DEMONSTRATION AND TRAINING

- A. Furnish 4 hours of instruction each for 4 persons, to be conducted at project site with manufacturer's representative.

END OF SECTION

SECTION 26 36 05
HEAVY-DUTY SAFETY SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and install heavy-duty, double-throw safety switches for manual transfer of loads between alternate sources of supply and single-throw safety switches for motor disconnect.

1.2 CODES AND STANDARDS

- A. The heavy-duty safety switches shall conform to the requirements of:
 - 1. UL 98 – Enclosed Switches
 - 2. Section 26 00 00 - Electrical Work, General.

1.3 SUBMITTALS

- A. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage and short circuit in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.1 SAFETY SWITCH

- A. The safety switches shall be heavy-duty, manually operated, single-throw switches, full load make or break rated. Switches shall include a NO contact that is made in the A and B position.
- B. Switch shall be UL listed for use as service equipment and is to be labeled for this application.
- C. Switch shall have switch blades which are visible when the switch is OFF and the cover is open.
- D. Lugs shall be front removable and UL listed for aluminum or copper.
- E. All current carrying parts shall be plated to resist corrosion.
- F. The UL listed short circuit current rating of the double throw switch shall be 10,000 rms symmetrical amperes.
- G. Provisions for padlocking the switch in the OFF position shall be provided.

2.2 ENCLOSURE

- A. The safety switch shall be furnished in a NEMA Type 1 enclosure with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galvanized steel.

- B. The enclosure shall be supplied with a metal nameplate which includes ON-OFF-ON markings.

2.3 MANUFACTURERS

- A. Safety switches shall be manufactured by Square D, Allen-Bradley, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The safety switch shall be installed in accordance with the Manufacturer's requirements and recommendations.

END OF SECTION

SECTION 26 50 00 LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide lighting fixtures, supports, and lamps, and accessories, complete and operable, in accordance with the Contract Documents.
- B. Related Sections:
 - 1. Section 26 00 00 - Electrical Work, General.

1.2 CONTRACTOR SUBMITTALS

- B. If the Contractor proposes to install equivalent equipment to that suggested, then he shall furnish the following product information in accordance Section 01 60 00 – Product Requirements.
 - 1. Interior luminaires
 - a. Catalog data sheets and pictures.
 - b. Luminaire finish and metal gauge.
 - c. Lens material, pattern, and thickness.
 - d. Candle power distribution curves in two or more planes.
 - e. Candle power chart 0 to 90 degrees.
 - f. Lumen output chart.
 - g. Average maximum brightness data in foot lamberts.
 - h. Coefficients of utilization for zonal cavity calculations.
 - i. Mounting or suspension details.
 - j. Heat exchange and air handling data.
 - 2. Exterior luminaires
 - a. Catalog data sheets and pictures.
 - b. Luminaire finish and metal gauge.
 - c. Lens material, pattern, and thickness.
 - d. IES lighting classification and isolux diagram.
 - e. Fastening details to wall or pole.
 - f. Ballast type, location, and method of fastening.
 - g. For light poles, submit wind loading, complete dimensions, and finish.
 - 3. Lamps
 - a. Voltages (120V Only).

- b. Colors.
- c. Approximate life (in hours).
- d. Approximate initial lumens.
- e. Lumen maintenance curve.
- f. Lamp type and base.
- 4. Ballasts
 - a. Type.
 - b. Wiring diagram
 - c. Nominal watts and input watts.
 - d. Input voltage (120V unless otherwise noted on Contract Drawings) and power factor.
 - e. Starting current, line current, and restrike current values.
 - f. Sound rating.
 - g. Temperature rating.
 - h. Efficiency ratings.
 - i. Low temperature characteristics.
 - j. Emergency ballasts rating and capacity data.

PART 2 - PRODUCTS

2.1 FIXTURES - GENERAL

- A. Luminaires: Specific requirements relative to execution of Work of this Section are located in the Luminaire Schedule on Contract Drawings.
- B. All fixtures shall be pre-wired with leads of 18-AWG, minimum, for connection to building circuits.

2.2 EXTERIOR FIXTURES

- A. Exterior fixtures in combination with their mounting pole and bracket shall be capable of withstanding 100 MPH winds without damage. Exterior fixtures shall have corrosion-resistant hardware and hinged doors or lens retainer. Fixtures specified to be furnished with integral photo-electrical control shall be of the fixture manufacturer's standard design.

2.3 INTERIOR FIXTURES

- A. Interior fluorescent fixtures without diffusers shall be furnished with end plates. Where diffusers are required, they shall be of high molecular strength acrylic. Minimum thickness of the acrylic shall be 0.125 inches for all diffusers, except that those on 4-foot square fixtures shall be 0.187 inches thick.

B. Emergency Exit Signs

1. Internally illuminated.
2. Universal mounting type.
3. Internal 6-volt nickel cadmium battery, 90 minutes capacity to emergency lamps.
4. Two-rate regulated battery charger to minimize energy consumption. Filtered charger output to minimize voltage ripple and extend battery life. Thermal protection and current-limiting charger circuitry to prevent overheating and charger failure.
5. 19,000 hours expected lamp life.
6. Press to test button.
7. Directional arrows.
8. Red letters on a white panel, 6 inches high.

2.4 LAMPS

- A. Lamps shall be first-line General Electric, Cutler-Hammer, Sylvania, or equal.
- B. Fluorescent lamps shall be cool/white unless otherwise indicated. Incandescent lamps shall be frosted unless a specified fixture lighting control system requires clear globe lamps. High-pressure sodium lamps shall be "color corrected." Unless otherwise indicated in the Contract Documents, lamps shall be suitable for operation in any burning position.

2.5 PHOTO-ELECTRIC CELLS

- A. Photoelectric cells for control of multiple fixtures shall be self-contained, weatherproof type, rated for 1800 va 120-volt, single pole, single throw, and shall be provided with time-delay features. Photoelectric cell shall be Tork Model 2101, or equal.

2.6 LIGHT FIXTURE CONTROL RELAYS

- A. Relays for light fixtures control shall be mechanically held. Such relays shall be based-mounted, single-purpose units, i.e., not attachments to a multi-purpose solenoid operator.
- B. If not indicated otherwise, coil voltage shall be 115 VAC with contacts rated at 20 amps. Relays shall be ASCO Series 166, Zenith Series MSC, or equal.

2.7 BALLASTS

- A. Ballasts for fluorescent fixtures in indoor areas shall have a Class "A" sound rating. Such ballasts shall be of the low loss type. All ballasts shall be high power factor, Class P. Primary ballast voltage shall be suitable for use in the branch circuits indicated in the Contract Documents. All ballasts shall be UL-listed.

2.8 FIXTURE TYPES

- A. Specific requirements are located in the Lighting Fixture Schedule on the Contract Drawings.

PART 3 - EXECUTION**3.1 LUMINAIRES**

- A. Install in accordance with manufacturer's recommendations.
- B. Provide necessary hangers, pendants, and canopies.
- C. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building required to safely mount.
- D. Install plumb and level.
- E. Locate luminaires to avoid both conflict with other building systems and blockage of luminaire light output.

3.2 LAMPS

- A. Provide in each fixture, the number and type for which the fixture is designed, unless otherwise indicated.

3.3 BALLASTS

- A. Install in accordance with manufacturer's recommendations.
- B. Utilize all ballast mounting holes to fasten securely within luminaire.
- C. Replace noisy or defective ballasts.

3.4 CLEANING FOLLOWING INSTALLATION

- A. Remove all labels and other markings, except UL listing mark and nameplates.
- B. Wipe luminaires inside and out to remove construction dust.
- C. Clean luminaire plastic lenses with antistatic cleaners only.
- D. Touch up all painted surfaces of luminaires and poles with matching paint ordered from manufacturer.
- E. Replace all defective lamps at time of Substantial Completion.

END OF SECTION

SECTION 26 99 90 ELECTRICAL HEAT TRACE

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 26 00 00 - Electrical Work, General.
- B. Section 26 05 03 –Equipment Wiring Connections

1.2 WORK INCLUDED

- A. This section describes specific requirements, products, and methods of execution relating to providing Electrical Heat Trace used on this project.

1.3 QUALITY ASSURANCE

- A. Heat Trace shall be listed or labeled.
- B. Heat Trace shall be identified as acceptable for use on plastic pipe.
- C. Codes, Approvals and Standards the electric heat-trace system shall conform to this specification. It shall be designed, manufactured, and tested in accordance with the applicable requirements of the latest edition of the following codes and standards.
 - 1. ANSI American National Standards Institute
 - 2. CEC Canadian Electrical Code
 - 3. CSA CSA International
 - 4. FM FM Approvals
 - 5. IEC International Electro-Mechanical Commission
 - 6. IEEE Institute Of Electrical and Electronics Engineers
 - 7. ITS Intertek Testing Services (Intertek ETL SEMKO)
 - 8. NEC U.S. National Electrical Code (NFPA 70)
 - 9. NEMA National Electrical Manufacturers Association
 - 10. NESC National Electrical Safety Code
 - 11. UL Underwriters' Laboratories, Inc.

1.4 SUBMITTALS

- A. The following items shall be included in the submittal:
 - 1. Quality Assurance: Verification that product is listed for the intended use (Water line Freeze Protection in Arctic Pipe.)
 - 2. "Cut" sheets are an acceptable format if all required data is presented in a readable manner. Where options are identified as available but not provided they

shall be marked out alternately identify only those options intended to be supplied with the component if none, then state so on the submittal.

PART 2 - PRODUCTS

- A. Self Regulating Heat Trace for Service Lines and Watering Point
 - 1. Self-regulating heater cable is a parallel circuit electric heater strip.
 - 2. An irradiation cross-linked conductive polymer core material is extruded over the multi-stranded, tin-plated, 18-gauge copper bus wires.
 - 3. The conductive core material increases or decreases its heat output in response to temperature changes.
 - 4. Two jackets provide extra dielectric strength, moisture resistance, and protection from impact and abrasion damage.
 - 5. A thermoplastic elastomer over jacket is then extruded over the inner jacket.
 - 6. A tinned copper braid is installed over the second jacket, providing a continuous ground path.
 - 7. A standard option UV stabilized polyolefin over jacket is available to cover the braid for wet applications.
 - 8. Maximum Maintenance Temp 150F
 - 9. Maximum intermittent Temperature 165F
 - 10. 8 Watts/Ft @120V
 - 11. Manufacturer NELSON CLT8

EXECUTION

2.2 INSTALLATION

- A. Installation shall consist of Heat Cable, End Kit, Power point.
- B. Intended use is for Arctic Pipe, collocated with glycol trace lines or residential water/sewer lines.

2.3 TESTING

- A. Factory inspections and tests for self-regulating heater cables shall include but are not limited to the following:
 - 1. Testing shall be done per the latest IEEE Std. 515 test section and applicable manufacturer's standards.
- B. Upon receipt OWNER will perform megger test to verify heating cable was not damaged during transit.
 - 1. The megger readings upon receipt shall be greater than 20 megohms. Otherwise, the heater cable is not acceptable and shall be replaced.
- C. After installation, complete the following forms (Examples included):

1. Periodic Inspection Form
2. Heat Trace Installation record



Temperature Maintenance Circuits -

Visual inspection inside connection box	Initial						
Damage or cracks (leaks) in insulation	Initial						
Heater cable properly connected and	Initial						
Thermostat checked for moisture, corrosion, set point, switch operation, and capillary damage	Set Point Initial Date						
Megger tests performed at power	Reading						
Watts/Ft.							
All connections, boxes, and thermostats	Initial						
End seals, covered splices and tees marked	Initial						

Heat Trace Installation Record

**NELSON
HEAT TRACE**

Location	System	Project Number	Reference Drawing(s)	
Trace Heater	Line Number	Area Classification	AIT / T-Classification	
Panel Number	Location	Circuit Number	Circuit Amp / Voltage	
Trace Heater Mfg	Heater Model	Trace Heater Wattage unit length / Voltage Rating		
Megohmmeter Manufacturer / Model		Voltage Setting	Accuracy / Full Scale	
Megohmmeter date of last calibration				
Multimeter Manufacturer / Model		Ohm Setting	Accuracy / Full Scale	
TRACE HEATER TESTING :		Test Value / remarks	Date	Initials
1. Receipt of Material on Reel				
Continuity Test on Reel (see note 1)				
Insulation Resistance Test on Reel				
2. Piping Completed (Approval to start heater installation)				
3. After Installation				
Continuity Test (see note 1)				
Insulation Resistance Test				
4. Trace heater Installed (Approval to start Thermal Insulation Installation)				
Trace heater correctly installed on pipe, vessel or equipment				
Trace heater correctly installed at valves, pipe supports, other heat sinks				
Components correctly installed and terminated (Power, Tee, End Seal)				
Installation agrees with manufacturers instructions and circuit design				
5. Thermal Insulation Installation Complete				
Continuity Test (see note 2)				
Insulation Resistance Test (5 megohm min)				

Performed by	Company	Date
Witnessed by	Company	Date
Accepted by	Company	Date
Approved by	Company	Date
NOTES		
<ol style="list-style-type: none">1. Note Minimum acceptable insulation resistance should be 20 megohms. Minimum acceptable test2. voltage is 500 Vdc. However 1000 Vdc recommended for MI, 2500 Vdc for polymeric cables.2. Continuity test on self-regulating heat trace only used for short or open circuit.		

END OF SECTION

DIVISION 31 EARTHWORK

SECTION 31 05 13 SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Imported fill: Material obtained by the Contractor from a source(s) outside of the community.

1.2 SUBMITTALS

- A. Certified gradation analysis for each fill material. Submit not less than 14 days prior to shipment for imported fill and not less than 7 days prior to use for local fill.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials used shall conform to the specifications provided unless otherwise approved by the Engineer.
- B. Existing borrow sources shall be tested and may be approved on a case-by-case basis.
- C. Materials high in chloride content, such as beach sand or gravel, shall not be used in contact with steel fittings or appurtenances.

2.2 CLASSIFIED AND BACKFILL

- A. Classified fill and backfill shall meet the requirements of ADOT&PF Subbase "B" material shall consist of earth, sand, gravel, rock, or combinations thereof containing no muck, peat, frozen material, roots, sod, or other deleterious matter and is compactable as described in Part 3. The following allowances will be made:
 - 1. Require 100% passing the 3" sieve.
 - 2. Allow 80 to 100% passing the 2" sieve.
 - 3. Allow 12 to 55% passing the No. 4 sieve.
 - 4. Allow up to 10% passing the No. 200 sieve.

2.3 PIPE BEDDING AND LEVELING COURSE

- A. Material used for pipe bedding shall meet the requirements of ADOT&PF Aggregate for Surface Course "D1" and shall consist of earth, sand, gravel, rock, or combinations thereof containing no muck, peat, frozen material, roots, sod, or other deleterious matter and is compactable as described in Part 3. The following allowances will be made:
 - 1. Allow 99% - 100% passing the 1" sieve.
 - 2. Allow up to 7% passing the No. 200 sieve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Water Control

1. Promptly remove and dispose of water as necessary to grade and compact backfill and install pipe. Do not lay pipe in standing water.
2. Remove water in a manner that minimizes soil erosion.
3. Provide continuous water control until backfill is complete.

B. Remove foreign material and backfill contaminated with foreign material.

3.2 SUBGRADE

- A. Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for pipe bedding below pipes.
- B. Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe settlement, notify Engineer. Engineer will determine the depth of over excavation, if any, required.

3.3 PIPE BEDDING, PIPE BACKFILL AND ROAD/PAD FILL

- A. Place material in uniform layers not more than 6 inches deep and compact to at least ninety-five percent (95%) of the material's maximum dry density as determined by modified proctor, ASTM D-1557.

3.4 COMPACTION WITH MOISTURE AND DENSITY CONTROL

- A. See Section 31 23 23 – Fill for compaction requirements.

3.5 COMPACTION WITHOUT MOISTURE AND DENSITY CONTROL

- A. Place aggregate fill in depths not exceeding 12-inches in thickness before compaction.
- B. Compact by routing construction equipment and/or rollers uniformly over the entire surface of each layer before the next layer is placed. A minimum of five passes using a vibratory roller is required or when aggregate fill movement is the same between each pass and rutting is less than ½ inch.
- C. Keep dumping and rolling area separate. Do not cover any lift by another until the required compaction has been completed.

3.6 MAINTENANCE OF BACKFILL

- A. After each excavation is backfilled, maintain the surface of the backfilled trench even with the adjacent ground surface until final surface restoration is completed.

- B. Add excavated material where necessary.

3.7 SETTLEMENT OF BACKFILL AND FILL

- A. Settlement of backfill or of fill or facilities constructed over backfill will be considered a result of defective compaction of backfill (or fill) and shall be corrected at Contractor's expense.

END OF SECTION

SECTION 31 23 16 EXCAVATION AND TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating trenches for utilities and structures.
 - 2. Compacted fill from top of utility bedding to subgrade elevations.
 - 3. Backfilling and compaction.
- B. Related Requirements:
 - 1. Section 31 05 13: Soils for Earthwork
 - 2. Section 33 11 13: Public Water Utility Distribution Piping
 - 3. Section 33 90 10: Pre-Insulated Arctic Pipe and Fittings

1.2 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.3 SUBMITTALS

- A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.
- B. Materials Source: Submit name of imported fill materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Provide adequate survey control to avoid unauthorized over excavation.
- B. Verify field measurements prior to fabrication.

1.5 COORDINATION

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.6 WEATHER LIMITATIONS

- A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.
- B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

- C. When air temperature is equal to or greater than 32 degrees F the excavation shall be backfilled by the end of a work day and shall not be left open overnight.

1.7 CONTRACTOR'S RESPONSIBILITY

- A. Contractor shall install and maintain shoring, sheeting, bracing, and sloping as necessary to support sides of excavations and prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed Work.
- B. Contractor shall be solely responsible for making all excavations in a safe manner. All excavation work shall be conducted in accordance with OSHA and other applicable governmental regulations and agencies.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. See 31 05 13: Soils for Earthwork

PART 3 - EXECUTION

3.1 GENERAL

- A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work.
- B. Do not over excavate without authorization of the Engineer.
- C. All excavations shall be conducted in accordance with OSHA requirements, which shall be the Contractor's responsibility.

3.2 PREPARATION

- A. Call Local Utility Line Information service not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 DEWATERING AND DRAINAGE

- A. Excavations shall be accomplished in such a manner that drainage is maintained and directed away from the excavation at all times, and shall prevent the destruction or loss of optimum granular material properties for permanent embankment construction due to excess moisture content, saturation or other adverse condition.
- B. Any areas not so drained shall be kept free of standing water by pumping or dewatering if necessary.
- C. Granular materials having excessive moisture content shall not be used in the Work, and shall not be removed from the limits of excavation. At all times, unsuitable materials shall be contained and not allowed to contaminate or otherwise damage suitable materials.
- D. Sedimentation outside of excavated area shall be prevented by the use of silt fabric fences or other approved means.

3.4 UNCLASSIFIED EXCAVATION

- A. All excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.5 STOCKPILING EXCAVATED MATERIAL

- A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.
- B. Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.
- C. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct road or streets.
- D. Do not stockpile excavated material adjacent to trenches and other excavations unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.
- E. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed work, if weight of stockpiled material could induce excessive settlement.

3.6 DISPOSAL OF SPOIL

- A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill and debris resulting from removal of organic matter, trash, refuse and junk at an approved location.

3.7 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
 - 1. Engineer and/or Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

- B. Use laser-beam instrument with qualified operator to establish lines and grades; OR maintain grade alignment of pipe using string line parallel with grade line and vertically above centerline of pipe.
 - 1. Establish string line on level batter boards at intervals of not more than 25 feet.
 - 2. Install batter boards spanning trench, rigidly anchored to posts driven into ground on both sides of trench.
 - 3. Set three adjacent batter boards before laying pipe to verify grades and line.
 - 4. Determine elevation and position of string line from elevation and position of offset points or stakes located along pipe route.
 - 5. Do not locate pipe using side lines for line or grade.

3.8 TRENCHING

- A. Excavate subsoil required for utility line installation.
- B. Remove lumped subsoil, boulders, and rock.
- C. Do not advance open trench more than 200 feet ahead of installed pipe.
- D. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.
- E. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
- F. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- G. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered.
- H. Cut out soft areas of subgrade not capable of compaction in place. Backfill with imported gravel material up to bottom of bedding and compact to density equal to or greater than requirements for subsequent backfill material.
- I. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- J. Correct over excavated areas with compacted backfill as specified for authorized excavation or as directed by Engineer.
- K. Remove excess subsoil not intended for reuse, from site.

3.9 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

- B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Design sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.10 BEDDING

- A. Place geotextile material, if required by the Drawings, within the footprint of the excavated trench prior to placing bedding material.
- B. Place material at bottom, sides and top of pipe as shown on Drawings.
- C. Place in continuous layers to minimum 6 inches compacted depth.
- D. Maintain optimum moisture content of bedding to attain required compaction density.
- E. Compact uniformly to minimum 95 percent of maximum density.

3.11 BACKFILLING

- A. Backfill to contours and elevations with unfrozen fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact.
- D. Employ placement method that does not disturb or damage, utilities in trench.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Do not leave more than 50 feet of trench open at end of working day.
- G. Protect open trench to prevent danger to the public.

END OF SECTION

SECTION 31 23 19 DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dewatering system.
 - 2. Surface water control system.
 - 3. Monitoring wells.
 - 4. System operation and maintenance.
 - 5. Water disposal.
- B. Related Sections:
 - 1. Section 01 50 00 - Temporary Facilities and Controls.
 - 2. Section 31 23 16 – Excavation and Trenching.
 - 3. Section 31 25 13 - Erosion Controls.

1.2 DEFINITIONS

- A. Dewatering includes the following:
 - 1. Lowering of ground water table and intercepting horizontal water seepage to prevent groundwater from entering excavations.
 - 2. Disposing of removed water.
- B. Surface Water Control: Removal of surface water within open excavations.

1.3 SYSTEM DESCRIPTION

- A. Provide dewatering and surface water control systems to permit Work to be completed on dry and stable subgrade.
- B. Furnish standby equipment to be stored at Project site and ready for immediate use upon failure of dewatering equipment, including pumps and portable generators.

1.4 REFERENCES:

- A. Alaska Department of Environmental Conservation (ADEC):
 - 1. AKR100000 - General Permit for Discharges from Large and Small Construction Activities.

2. Alaska Storm Water Guide - December 2011.
3. ADEC User's Manual - Best Management Practices for Gravel/Rock Aggregate Extraction Projects - September 2012.

1.5 PERFORMANCE REQUIREMENTS

- A. Design dewatering systems to:
 1. Permit Work to be completed on dry and stable subgrade.
 2. Prevent damage to adjacent properties, structures, utilities, and facilities from construction operations.
 3. Prevent loss of fines, quick condition, or softening of foundation subgrade.
 4. Maintain stability of sides and bottoms of excavations.
 5. Prevent the pollution of nearby waterbodies, including drainages, ponds, lakes and rivers.
- B. Design surface water control systems to:
 1. Collect and remove surface water and seepage entering excavation.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Permits:
 1. Submit copy of ADEC dewatering permit to Architect/Engineer with dewatering plan no later than 10 days prior to conducting dewatering operations.
- C. Dewatering Plan:
 1. At least ten days prior to conducting dewatering operations submit an ADEC-approved dewatering plan and operation schedule for dewatering of each excavation for review by the Engineer.
 2. Acceptance of the Contractor's dewatering plan by the Engineer shall not relieve the Contractor of the responsibility of exercising reasonable precaution, sound engineering judgment, prudent construction practices, overloading or misuse of existing or new structures, the adequacy and safety of such work, and potential damage or undermining of existing or completed work.
- D. Shop Drawings:
 1. Indicate dewatering system layout, dewatering pump locations, pipe sizes and capacities, surface water control devices, valves, and water disposal method and location.
 2. Indicate primary and standby power system location and capacity.
 3. Include detailed description of dewatering and monitoring system installation procedures and maintenance of equipment.
 4. Include description of emergency procedures to follow when problems arise.

- E. Product Data: Submit data for each of the following:
 - 1. Dewatering Pumps: Indicate sizes, capacities, priming method, characteristics.
 - 2. Pumping equipment for control of surface water within excavation.
- F. Field Reports: Test and monitoring reports as specified in Field Quality Control article.

1.7 QUALITY ASSURANCE

- A. Comply with State and Federal authorities having jurisdiction for the following:
 - 1. Water discharge and disposal from pumping operations.
 - a. Under no circumstances shall dewatered volumes be discharged into any water body, unless treated in an ADEC-approved manner to produce an effluent that meets State water quality standards or meets discharge permit standards, whichever is most stringent. Testing to verify sufficient effluent water quality shall be provided by the Contractor at no additional cost to the Village Safe Water Program.
 - b. Any violations, and therefore any penalties and fines resulting from such violations, regarding disposal of dewatering effluent shall be borne solely by the Contractor.
- B. Provide Storm Water Pollution Prevention Plan (SWPPP) and perform dewatering Work in accordance with ADEC AKR100000 - *General Permit for Discharges from Large and Small Construction Activities* obtained by Contractor.
- C. Maintain one copy of SWPPP document on site.

1.8 SEQUENCING

- A. Sequence work to obtain required permits before start of dewatering operations.
- B. Sequence work to install and test dewatering and surface water control systems minimum seven days before starting excavation.

1.9 COORDINATION

- A. Coordinate work to permit the following construction operations to be completed on dry stable substrate.
 - 1. Excavation specified in Section 31 23 16.

PART 2 - PRODUCTS

2.1 DEWATERING EQUIPMENT

- A. Select dewatering equipment to meet specified performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 02 22 00 – Existing Conditions Assessment: Verification of existing conditions before starting work.
- B. Conduct additional borings and investigations to supplement subsurface investigations identified in Supplementary General Conditions as required to complete dewatering system design.

3.2 PREPARATION

- A. Protect existing adjacent structures and improvements from any damage caused by dewatering operations.

3.3 DEWATERING SYSTEM

- A. Install dewatering system in accordance with shop drawings.
- B. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public rights-of-way, and adjacent buildings, structures, and improvements.

3.4 SURFACE WATER AND GROUNDWATER CONTROL SYSTEM

- A. Provide Best Management Practices (BMPs) for controlling drainage from surface water, groundwater and dewatering efforts and mitigating pollution as required in ADEC AKR100000 - *General Permit for Discharges from Large and Small Construction Activities*.
- B. Provide ditches, berms, and other devices in the limits of excavation to divert and drain surface water and groundwater from the area being excavated as specified in Section 31 23 16 - Excavation.
- C. Control and remove unanticipated water seepage into excavation.
- D. Divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels and settling basins to minimize water turbidity in accordance with ADEC dewatering permit requirements.
- E. Control the rate and effect of dewatering in such a manner as to prevent all objectionable sedimentation, erosion and subsidence.
- F. Perform dewatering operation as to:
 - 1. not destroy or weaken the strength of the soil under or alongside the excavation.
 - 2. prevent excavated soil and soil yet to be excavated from becoming saturated with groundwater, gaining excessive water content, or otherwise becoming unsuitable for use in the Work.

3.5 SYSTEM OPERATION AND MAINTENANCE

- A. Operate dewatering system continuously until excavation and fill construction is complete.
- B. Provide 24-hour supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.
- C. Conduct daily observation of dewatering system and monitoring system. Make required repairs and perform scheduled maintenance.
- D. Fill fuel tanks before tanks reach 25 percent capacity. Store fuel and lubricants in accordance with Section 01 50 00 - Temporary Facilities and Controls.
- E. Start emergency generators at least twice each week to check operating condition.
- F. When dewatering system cannot control water within excavation, notify Architect/Engineer and stop excavation work.
 - 1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
 - 2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.
- G. Modify dewatering and surface water control systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.
- H. Correct unanticipated pressure conditions affecting dewatering system performance.
- I. Do not discontinue dewatering operations without Architect/Engineer's approval.

3.6 WATER DISPOSAL

- A. Discharge water into drainage channels and settling basins in accordance with ADEC Dewatering Permit and SWPPP.
- B. Water shall be disposed of in accordance with the discharge permit and ADEC-approved dewatering plan, and as not to cause injury to public or private property or to cause a nuisance or menace to the public.
- C. Contractor's failure to obtain or abide by the stipulations set forth in the ADEC-approved dewatering plan and discharge permits shall give the Owner sufficient justification to suspend all work until deficiencies are corrected to the satisfaction of the Engineer. Such work suspension shall not be eligible for additional compensation in extra payment or Contract time.
- D. Construction of temporary facilities to dispose of water shall be incidental to the cost of construction.

3.7 SYSTEM REMOVAL

- A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

3.8 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements and Section 01 70 00 - Execution and Closeout Requirements: Field inspecting.

END OF SECTION

SECTION 31 23 23 FILL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fill for pipe bedding.
 - 2. Fill for access road and wellhouse pads.
- B. Related Sections:
 - 1. Section 31 05 13 – Soils For Earthwork.
 - 2. Section 31 23 16 – Excavation and Trenching.
 - 3. Section 31 34 19 – Geotextile Products.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³).
 - 2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³).
 - 4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - 7. Alaska Department of Environmental Conservation - On-site Wastewater Installation Manual 2016.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- C. Materials Source: Submit name of imported fill materials suppliers.
- D. Manufacturer's Certificate: Certify that products, including imported fill materials, meet or exceed specified requirements.

1.4 PROJECT CONDITIONS

- A. Site Protection: Conform to the requirements of Section 01 50 00, Temporary Facilities and Controls.
- B. Permits: Obtain discharge permit from ADEC for all dewatering operations.
- C. All embankment work shall be performed when soil conditions will so allow without destruction or detrimental loss of soil material strength.
- D. Embankments shall be compacted when soil conditions will so allow without destruction or detrimental loss of soil material strength.
- E. Final grading and seeding work shall be performed within one month after ground thaw and no later than specified in Section 32 92 19, Seeding.
- F. Any work performed in inclement weather shall be at Contractor's sole risk.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Section 31 23 00 - Earthwork.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify that existing ground conditions are sufficiently dry or dewatered to receive stockpiled soil without compromising its ability to be constructed into a compacted embankment or otherwise be used in the Work as required.

3.2 EMBANKMENT CONSTRUCTION

- A. Systematically construct access road and pad in lifts. Construct fills on required geotextile surfaces.
- B. Place material in continuous layers as follows:
 - 1. Subbase Material: Maximum 12 inches compacted depth each lift.
 - 2. Driving Surface Material: Maximum 6 inches compacted depth.

- C. Employ placement method that does not disturb or damage other work.
 - 1. Do not damage geotextiles during placement of fill. Replace entire sections of damaged geotextile with new geotextile of same size, product and manufacturer.
- D. Do not spread, manipulate or compact fill materials when material is excessively wet and its structural capability will be damaged as a result.
- E. Compaction: Contractor shall use a vibratory-roller to achieve compaction of pad material to at least 95% of maximum dry density (modified Proctor), as noted in the Drawings.
 - a. On-site density measurement shall be accomplished by Method ASTM D2922, Nuclear Methods, ASTM D1556, Sand-Cone Method or ASTM D2167, Rubber-Balloon Method as compared to optimum density determined by ASTM D698.
- F. Slope constructed pad to grade as shown.
- G. Make gradual grade changes. Blend slope into level areas.
- H. Cover edge of pad surface layer with a mixture of local organic silt and topsoil as shown in the Drawings. Track walk surface of embankments in direction perpendicular to the slope prior to seeding.
- I. Seed pad edges in accordance with Section 32 90 01 Seeding.
- J. Leave fill material stockpile areas free of excess fill materials.

3.3 PIPE BEDDING

- A. All piping shall be placed in bedding material as specified.
- B. Bedding shall be placed under and around the pipe a minimum of 12 inches and compacted to 95% of maximum dry density (modified Proctor).

3.4 PROTECTION OF WORK:

- A. Protect and maintain all areas of completed work against any detrimental effects due to weather, by approved means until final acceptance.
 - 1. Repair areas damaged as a result of storms or construction activities.
 - 2. Any areas of completed work left unprotected that are damaged by wind or rain shall be replaced or reconditioned, reshaped and re-compacted by Contractor to the Architect/Engineer's satisfaction prior to further construction without additional cost to the Owner.
 - 3. Take necessary precautions to prevent the entrance of soils and other materials into streambeds, lakes or water courses.

3.5 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Top Surface of General Pad and Access Road Construction: Plus or minus 0.1 foot from required elevations.

3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements and Section 01 70 00 - Execution and Closeout Requirements.
- B. Gravel: Perform laboratory material tests in accordance with ASTM D698.
- C. Gravel: Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D698 and ASTM D2922 or D1556 or ASTM D2167.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- E. Frequency of Tests:
 - 1. Backfill of trenches - One test every 150 linear feet of each lift and one test within each segment between changes in direction.
 - 2. General fill – one test every 5,000 square feet of each lift.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 25 13 EROSION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Site Stabilization
 - 1. Related Requirements:
 - 2. Section 31 05 13: Soils for Earthwork
 - 3. Section 31 11 00: Clearing and Grubbing
 - 4. Section 31 23 16: Excavation and Trenching
 - 5. Section 32 90 01: Landscape Restoration

1.2 SUBMITTALS

- A. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Section 31 05 13, Section 31 11 00, Section 31 23 16, and Section 32 90 01, as applicable.
- B. Perform Work in accordance with SWPPP.
- C. Maintain one copy of SWPPP on site.

PART 2 - PRODUCTS

2.1 PLANTING MATERIALS

- A. Seeding: as specified in Section 32 90 01, Landscape Restoration.

2.2 EROSION CONTROL FIBER COMPOUND:

- A. Erosion control fiber compound shall be used for all slopes greater than 10:1. For shallower slopes and flat terrain, jute fabric may be used – see Section 31 34 19.
- B. Fiber compound may be applied by hand, mechanically, hydraulically or aurally as specified by manufacturer.
- C. Material shall meet the following requirements:
 - 1. Cellulose Fiber > 85%
 - 2. Corn Fiber > 10%
 - 3. Fiber Stabilizing Compound > 1%
 - 4. pH 6.5% ± 0.4%
 - 5. Moisture Content 10% ± 2%

- 6. Non-Toxic To Plant and Animals Yes
- D. Product application rate and soil preparation shall conform to manufacturer's requirements for the specific type of soil, slope and weather of the region. Grade and track-walk the areas to be covered in accordance with manufacturer's recommendations.
- E. Seed and Fertilizer may be combined with product during application; See Section 32 90 01, Landscape Restoration.
- F. Product: EarthGuard Fiber Matrix or Edge pellets, as manufactured by Terra Novo, Inc., or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Verify subgrade or stabilized soil is acceptable and ready to support devices and imposed loads.
- C. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SITE STABILIZATION

- A. Incorporate erosion control devices at the earliest practicable time.
- B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
- C. Stockpile and waste pile heights shall not exceed 8 feet. Slope stockpile sides at 2H:1V or flatter.
- D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
 - 1. During non-germinating periods, apply mulch at recommended rates.
 - 2. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 32 90 01 permanent seeding specifications.
- E. Stabilize constructed slopes and embankments, diversion channels and stockpiles immediately:
 - 1. All constructed slopes and embankments and temporary stockpile areas, including landfill, dump close-out and borrow areas, shall be stabilized with erosion control fiber compound in accordance with the manufacturer's instructions,
 - 2. Other areas disturbed by construction or otherwise needing stabilization may be stabilized with the use of erosion control fiber compound or jute mesh installed in accordance with the manufacturer's instructions.
 - 3. All embankments, stockpiles left in place and disturbed areas shall be seeded in accordance with Section 32 90 01, Landscape Restoration.

3.3 FIELD QUALITY CONTROL

- A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

3.4 CLEANING

- A. Do not damage surface grading and established vegetation during cleaning operations.
- B. Do not permit sediment to erode into construction or site areas or natural waterways.
- C. Clean channels when depth of sediment reaches approximately one half channel depth.

END OF SECTION

SECTION 31 34 19 GEOTEXTILE PRODUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this section includes the furnishing of all labor, equipment, material, and supervision to install geotextile at the locations specified on the Plans.

1.2 RELATED SECTIONS

- A. Section 01 60 00: Product Requirements.
- B. Section 31 23 23: Fill.

1.3 SUBMITTALS

- A. Furnish Manufacturer's information and design data, including complete installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- A. General Requirements: Refer to Section 01 60 00, Product Requirements.
- B. Packaging and Identification Requirements:
 - 1. Fabrics shall be provided in rolls wrapped with protective covering to protect the fabric from mud, dirt, dust, and debris.
 - 2. The fabric shall be free of defects or flaws which significantly affect its physical properties.
 - 3. Each roll of fabric in the shipment shall be labeled with a number or symbol to identify that production run.

1.5 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer of the separation geotextile material shall normally be engaged in the business of geotextile fabrics.
- B. Sampling and Compliance Requirements:
 - 1. A competent laboratory must be maintained by the producer of the fabric at the point of manufacture to ensure quality control in accordance with ASTM testing procedures.
 - 2. That laboratory shall maintain records of its quality control results and provide, upon request of the specifying agent prior to shipment, a manufacturer's certificate.

3. The certificate shall include:
 - a. Name of manufacturer
 - b. Chemical composition
 - c. Product description
 - d. Statement of compliance to specification requirements
 - e. Signature of legally authorized official attesting to the information required.
- C. Weather Limitations: All work shall be performed under weather conditions recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fabric shall be woven, suitable for armor stone erosion control applications or soil separation applications as applicable, having the following minimum properties:
 1. Fabrics shall be inert to commonly encountered chemicals, hydrocarbons, and mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, and conform to the properties in the following table.
 2. The average roll minimum value (weakest principle direction) for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the average roll minimum value (weakest principle direction) stipulated herein.

2.2 SEPARATION GEOTEXTILE

- A. Fabric shall be a woven fabric having the following minimum properties:

<u>Property</u>	<u>Specification Limit</u>	<u>Test Method</u>
Grab Tensile Strength	250 lbs	ASTM D-4632
Grab Elongation	15% max	ASTM D-4632
Trapezoidal Tear	90 lbs	ASTM D-4533
Puncture Strength	750 lbs	ASTM D-6241
Apparent Opening Size	40 US Std.	ASTM D-4751
Water Flow Rate	6 gal/min/sq ft	ASTM D-4491

- B. Acceptable products include Geotex 250 ST by Propex Geotextile Systems, or approved equal.

2.3 JUTE FABRIC

- A. Jute fabric may be used for general erosion control applications, except where Erosion Control Fiber Compound is required as specified in Section 31 25 13, Erosion Controls.
- B. Jute fabric shall be of natural materials with no weed seeds 100% and biodegradable Jute netting. The fabric shall have curled, interlocking fibers with barbed edges, and be suited specifically for erosion control purposes.
- C. Jute fabric shall be furnished in rolled strips and shall meet the following requirements:
 - 1. Width: 96 inches plus or minus 1-inch.
 - 2. USLE Cover Management Factor: 0.022.
 - 3. Suitable for slopes up to 1.5:1.
 - 4. Weight of 0.73 lb/yd² with a tolerance of plus or minus 10%.
 - 5. Fabric shall have netting on both top and bottom.
- D. Staples shall be U-shaped and shall be approximately 6-inches long and 1-inch wide and meet the following minimum requirements unless a larger staple is recommended by the manufacturer:
 - 1. Machine made staples may be of No. 11 gauge or heavier steel wire.
 - 2. Handmade staples shall be made from No. 9 gauge or heavier steel wire.
- E. Acceptable brand shall be Curlex II Fibrenet and manufactured by American Excelsior Company, or approved equal.

PART 3 - EXECUTION

3.1 SEPARATION GEOTEXTILE AND JUTE MESH FABRIC

- A. Storage, handling and installation of the separation geotextile and erosion control fabric shall be in conformance with the Manufacturer's recommendations, and as specified in AASHTO M288, *Geotextile Specification for Highway Applications*.
- B. Preparation: All surfaces to be lined shall be smooth and free of all sharp rocks and objects per manufacturer's recommendations.
- C. Fabric Installation:
 - 1. The fabric sheet shall be unrolled, positioned, and drawn tight without stretching.
 - a. Other applications: Overlaps when necessary shall be 36 inches minimum on longitudinal end joints and 36 inches on roll end joints.
 - 2. Fabrics shall be anchored as recommended by the manufacturer and shown in the Plans.
 - 3. Construction vehicles will not be allowed to traffic directly on the fabric.

END OF SECTION

SECTION 31 68 05**EARTH ANCHORS****PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Earth Anchors.
 - 2. Galvanized Steel Wire Rope.
 - 3. Galvanized Malleable Wire Rope Clips.

1.2 DEFINITIONS

- A. Duckbill® earth anchor: The anchor body is driven into the soil to the proper depth and then a backward pull on the cable is applied that rotates the anchor body in the ground until it is perpendicular to the cable.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for earth anchor.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

PART 2 PRODUCTS**2.1 EARTH ANCHORS**

- A. Configuration as shown in the drawings.
- B. Suppliers:

1. Foresight Products, LLC.
 2. Arctic Wire Rope and Supply Inc.
- C. Earth Anchor shall be anodized ductile iron multi-purpose earth anchors with an anchor holding capacity, in soil comprised of silty sand, sandy silt, or silt, of 3,000 lbs or more. Each earth anchor shall be a minimum of 6 inches in length and have a minimum diameter of 1.3 inches. Earth anchor shall be Duckbill Model 88 or approved equal.

2.2 ACCESSORIES

- A. 1/4-inch Galvanized Wire Rope
1. Performance Standard and Dimensions: Federal Specification MIL-DTL-83420M
 2. Material: Drawn galvanized high carbon steel per Federal Specifications MIL-DTL-834020M
 3. Working Load Limit: 1,400 lbs.
 4. Minimum Breaking Strength: 7,000 lbs.
- B. Galvanized Malleable Wire Rope Clip
1. Material and Mechanical Properties: Federal Specifications FF-C-450D Type 1 Class 2.
 2. Saddle Hardness: HRB 83 maximum.
 3. Thread Requirements: Nut Fit, Threads are acceptable when torque tested per FF-C-450D.
 4. Coating:
 - a. U-Bolt and Nuts: Fe/Zn3A per ASTM F1941.
 - b. Saddle: Hot dipped galvanized per ASTM A153 or F2329.

2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 EARTH ANCHOR INSTALLATION

- A. Install earth anchor using a heavy hammer and drive rod or jack hammer and power drive rod to required depths per drawings. Earth anchors shall be installed below the active layer. If installation is performed when the active layer is frozen, Contractor may pre-drill a 1-inch pilot hole a maximum of 18 inches below the surface.
- B. Earth anchors shall be set by pulling the anchor until the anchor rotates into the load lock position. Anchor may be set by applying upward pressure by hand, jack, or post puller.

END OF SECTION 31 68 05

DIVISION 32 EXTERIOR IMPROVEMENTS

SECTION 32 12 16
ASPHALT CONCRETE PAVEMENT

DIVISION 400—ASPHALT PAVEMENTS AND SURFACE TREATMENTS

SECTION 401 ASPHALT CONCRETE PAVEMENT

401.1 General

Asphalt concrete pavement placed under this contract shall conform to Section 401 of the State of Alaska Department of Transportation and Public Facilities, Standard Specifications for Highway Construction, 2020, unless otherwise stated. All references to the “State” are changed to the “City.” Delete all references to the asphalt price adjustment. No asphalt price adjustment shall be applied.

The following changes apply to the above mentioned Standard Specifications:

401-2.01 COMPOSITION OF MIXTURE – JOB MIX DESIGN.

Add the following:

Furnish mixes of aggregate, asphalt binder, and additives that meet the applicable gradation and material requirements of Type II, Class A or B mix. Asphalt cement shall be grade PG 52-28.

401-3.16 COMPACTING.

Add the following paragraph:

Depth of Asphalt shown on plans represents the compacted depth. Monitor the compaction process with nuclear density gauges. Cut 6-inch diameter full depth core samples from the compacted pavement within 24 hours after final rolling. Neatly cut the samples with a core drill at the randomly selected locations designated by the City. Fill and compact the core holes with asphalt concrete mixture. Label the cores and protect them from damage due to handling or temperature during storage. Perform specific gravity and thickness tests on the cores and deliver them to City.

401-4.02 Acceptance Sampling and Testing.

Delete this article in its entirety and substitute the following:

Contractor shall be responsible for all sampling, testing, and reporting testing requirements. Any area of finished surfacing that is visibly segregated, fails to meet surface tolerance requirements, or cools to below 150 °F before completing compaction, is considered unacceptable per Subsection 105-1.11.

Sample material to be tested according to the Sampling and Testing Requirements at the end of this section. In addition, sample any material that appears defective or inconsistent with similar material being produced unless such material is voluntarily removed and replaced or corrected.

Sample and split samples according to AASHTO or other acceptable procedures. Allow the City representative the opportunity to witness all sampling. Immediately perform splits when required.

Provide test reports for each batch of asphalt cement showing conformance to the specifications in Section 702 before delivery to the project. Require that the storage tanks used for each batch be noted on the test report, the anti-strip additives required by the mix design be added during load out for delivery to the project,

and a printed weight ticket for anti-strip is included with the asphalt cement weight ticket. The location where anti-strip is added may be changed with the written approval of the Engineer.

Furnish the following documents at delivery:

1. Manufacturer's certificate of compliance (Subsection 106-1.05).
2. Conformance test reports for the batch (provide prior to delivery as noted above).
3. Batch number and storage tanks used.
4. Date and time of load out for delivery.
5. Type, grade, temperature, and quantity of asphalt cement loaded.
6. Type and percent of anti-strip added.

Table 401 - 1 Asphalt Sampling and Testing Requirements

Material	Characteristic	Test Method	Sampling Frequency	Point of Sampling	Reporting Time
Asphalt Pavement	Gradation	AASHTO T 30	1 per 400 tons	Behind paver before compaction	24 hours
	Content	AASHTO T 308	1 per 400 tons	Behind paver before compaction	24 hours
	Core Density	AASHTO T 166 & T 209	1 per 400 tons	In-place through coring	24-hours
	Compaction	ASTM D 2950	1 per 1500 yd ² and/or 1 per patch	After final rolling	24 hours

401-4.03 Evaluation of Materials for Acceptance.

Delete this article in its entirety and substitute the following:

Asphalt Concrete Pavement that does not meet the allowable specification tolerances listed in Article 401-2., Composition of Mixtures, will be removed from the project and replaced with fresh asphalt concrete pavement that meets specification at no additional cost to the Owner.

401-5.01 Basis of Payment.

Delete this article in its entirety and substitute the following:

Asphalt cement, anti-stripping additives, tack coat, crack sealing, surface sealing of longitudinal joints, surface tolerance corrections, and patching defective areas are subsidiary to the associated Hot Mix Asphalt Pay Items.

Failure to cut core samples within the specified period will result in a deduction of \$100.00 per sample per day (Subsection 401-4.02). Failure to backfill voids left by sampling with the specified period will result in a deduction of \$100 per hole per day (Subsection 401-4.02.)

Payment will be made under:

Pay Item No.	Pay Item	Pay Unit
401	Asphalt Pavement	Square Yard

**SECTION 32 90 01
LANDSCAPE RESTORATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fertilizing
 - 2. Seeding
 - 3. Maintenance

1.2 REFERENCE STANDARDS

- A. ASTM International:
 - 1. ASTM C602: Standard Specification for Agricultural Liming Materials.

1.3 DEFINITIONS

- A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

- A. Statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within six (6) months before the date of delivery on the project. This statement shall include:
 - 1. Name and address of laboratory
 - 2. Date of test
 - 3. Lot number for each kind of seed
 - 4. Results of tests as to name
 - 5. Percentages of purity and of germination
 - 6. Percentage of weed content for each kind of seed furnished
 - 7. Proportions of each kind of seed
- B. Certification from grower certifying the grass species.
- C. The Contractor shall submit the certification tag for the seed mixes provided listing species, proportion by weight, percent purity, and percent germination.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall deliver seed to the site in its original unopened container, which shall bear the vendor's guarantee of analysis.
- B. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable.

- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.6 JOB CONDITIONS

- A. Areas landscaped and/or seeded prior to construction shall be restored to their original condition.
- B. Unless otherwise specified, the Contractor shall reseed grassed areas that are disturbed during construction.
- C. Grass:
 - 1. Grass shall be sown in all areas that are excavated or disturbed during construction.
 - 2. Grass seeding shall follow backfilling operations by not more than 3 weeks.
 - 3. Weekly seeding shall be required for projects in which all backfilling cannot be completed in 3 weeks.
- D. All areas to be planted, seeded or sodded shall be accomplished in accordance with this Section.
- E. Except for road shoulders all non-paved areas within the cleared limits and other areas disturbed as a result of the work of this contract shall be graded to match undisturbed existing ground level or final grade as shown on the Drawings and seeded in accordance with this Section, unless otherwise indicated or directed by the Engineer.

1.7 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for two cuttings.

PART 2 - PRODUCTS

2.1 GRASS SEED

- A. Grass seed of the type hereinafter specified shall conform to the standards of State Department of Agriculture.
- B. Seed shall be furnished in standard unopened containers on which shall be shown the following information:
 - 1. Common name of seed
 - 2. Lot number
 - 3. Net weight
 - 4. Percentage of purity
 - 5. Percentage of germination (in case of legumes percentage of germination to include hard seed)
 - 6. Percentage of weed seed content and inert material clearly marked for each kind of seed in accordance with applicable state and federal laws.

- C. Seed Mix:
 - 1. 'Norcoast' Bering hairgrass 45% by weight
 - 2. 'Arctared' red fescue 30% by weight
 - 3. Wainwright Slender Wheatgrass 20% by weight
 - 4. Annual rye 5% by weight
- D. Seed mix shall be ninety-five percent (95%) pure with a minimum germination rate of seventy-five percent (75%).

2.2 FERTILIZER

- A. Fertilizer shall be a standard commercial grade of organic or inorganic fertilizer of the kind and quality specified herein.
- B. It shall contain no cyanamid compounds or hydrated lime.
- C. It may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid, and water-soluble potash in the amounts specified.
- D. All fertilizers shall be furnished in standard unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked all in accordance with state and federal laws.
- E. Fertilizer shall be ground to fineness as required for the method of application.
- F. Recommended fertilizer for seeded areas:
 - 1. Total Nitrogen.....20%
 - 2. Available Phosphoric Acid20%
 - 3. Water Soluble Potash..... 10%

2.3 WATER

- A. Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify prepared soil base is ready to receive the work of this section.
- B. Fertilize and seed all non-road areas disturbed by trenching and clearing operations.

3.2 PREPARATION

- A. Seeding shall not be done during windy weather or when the ground is frozen, excessively wet or otherwise untillable.

- B. The finish grade of all areas to be planted with grass shall be smooth, without visible depressions or mounds.
- C. After establishing the finish grade, all areas shall be hand raked, rolled and again hand raked, removing all rocks, weeds and debris.

3.3 FERTILIZER

- A. Application rate: 450 pounds per Acre.
- B. Do not apply fertilizer at same time or with same machine used to apply seed.
- C. Mix fertilizer thoroughly into upper 2 inches of soil.
- D. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.4 SEEDING

- A. The exact time for seeding will be determined by actual weather conditions. The normal satisfactory periods for seeding shall be considered as being between May 15 and August 15.
- B. Application rate: 40 pounds per Acre.
- C. Spread evenly in two intersecting directions. Rake in lightly.
- D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.
- E. Roll seeded area with roller not exceeding 112 lbs/linear foot.
- F. Apply water with fine spray immediately after planting. Saturate to 4 inches of soil.

3.5 SEED PROTECTION

- A. Cover seeded slopes where the grade is 3 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- B. Lay fabric smoothly on the surface, bury the top end of each section in a 6 inches deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.
- C. Secure outside edges and overlaps at 36 inch intervals with stakes.
- D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.6 MAINTENANCE

- A. Water to prevent grass and soil from drying out.

- B. Roll surface to remove minor depressions or irregularities.
- C. Immediately reseed areas showing bare spots.
- D. Repair washouts or gullies.
- E. Protect seeded areas with warning signs during the maintenance period (2 weeks).

3.7 PLANTING DELAY

- A. When delays in operations carry the work beyond the most favorable planting season, or when weather conditions are such that satisfactory results are not likely to be obtained for any stage of the seeding operations, the Contractor will stop the work and it shall be resumed only when the desired results are likely to be obtained or when approved alternates or corrective measures and procedures are adopted.

3.8 FINAL INSPECTION

- A. Final inspection for seeded areas will not be made until 30 days following installation of all seeding and fertilizing as specified.
- B. Damage caused by the Contractor to areas which have been seeded shall be repaired and/or replaced by the Contractor at his own expense.

3.9 GUARANTEE

- A. Guarantee of planting and seeding shall continue for 1 calendar year from date of final acceptance.
- B. Contractor shall reseed all grass dead or dying within the guarantee period.
- C. Guarantee shall include both materials and labor. Replacements shall be the same as originally planted.

END OF SECTION

DIVISION 33 UTILITIES

SECTION 33 11 13
PUBLIC WATER UTILITY DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Raw water system.
- B. Work Description:
 - 1. The work includes construction of new raw water piping. Locations for new raw water piping are shown in the Drawings.
 - 2. All new raw water piping will consist of insulated High Density Polyethylene (HDPE) core piping with:
 - a. Aluminum jacketing at above-grade locations as shown in the Drawings and described in this Specification and elsewhere in the Project Documents.
 - b. HDPE jacketing at below-grade locations as shown in the Drawings and described in this Specification and elsewhere in the Project Documents.
 - 3. All HDPE pipe and fittings shall be from a single manufacturer, who is fully experienced, reputable and qualified in the manufacture of the HDPE pipe to be furnished. The pipe shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications.
- C. Related Requirements:
 - 1. Section 33 90 10: Pre-Insulated Arctic Pipe and Fittings

1.2 REFERENCE STANDARDS

- A. ASTM International
 - 1. ASTM D3035: Standard Specification for PE Pipe (DR-PR) Based on Controlled Outside Diameter
 - 2. ASTM D3261: Butt Heat Fusion PE Fittings for PE Pipe and Tubing
 - 3. ASTM D3350: Standard Specification for PE Pipe & Fittings Materials
 - 4. ASTM D1238: Melt Flow Index
 - 5. ASTM D1505: Density of Plastics
 - 6. ASTM D2837: Hydrostatic Design Basis
 - 7. American Water Works Association
 - 8. AWWA C651-05: Disinfecting Water Mains
 - 9. AWWA C901: Polyethylene (PE) pressure Pipe & Tubing, ½ inch through 3-inch for water.
 - 10. AWWA C906: Polyethylene (PE) pressure Pipe & Fittings, 4-inch through 63-inch for water.

- B. National Sanitation Foundation
 - 1. NSF Standard #14: Plastic Piping Components and Related Materials
 - 2. NSF/ANSI-61: Drinking Water System Components-Health Effects
 - 3. NSF/ANSI-372: Drinking Water System Components-Lead Content
- C. Plastic Pipe Institute
 - 1. TR-33/2012: Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe

1.3 EXISTING WATER SUPPLY PIPING

- A. Contractor shall not inhibit the Owner's efforts to operate and maintain any part of the existing utility. Owner shall have full access to the existing system at all times.
- B. The Owner reserves the right to make use of any portion of the proposed work prior to completion of the entire Contract without invalidating the Contract and without constituting acceptance of any of the work.

1.4 SUBMITTALS

- A. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.
- B. Shop Drawings: See Section 33 90 10 – Pre-Insulated Arctic Pipe and Fittings
- C. HDPE Fusion Procedure Certifications (Butt Fusion) for all personnel performing butt fusion in the field on HDPE pipe.
- D. Project Record Documents: Record location of pipe runs, connections, valves, cleanouts and invert elevations.
- E. HDPE butt fusion joint records.

PART 2 - PRODUCTS

2.1 MATERIALS FOR PIPE (ALL SIZES)

- A. Pipe shall conform to Section 33 90 10 and the Drawings.

2.2 GATE VALVES – NOT USED

2.3 BUTTERFLY VALVES – NOT USED

2.4 BRASS BALL VALVES

- A. 2-piece, full port lead free brass ball valve
- B. PTFE seats and stem packing
- C. Adjustable packing gland

- D. Rated to 150 psi working standard pressure
- E. Watts LFFBV-3C-M1, or approved equal

2.5 HDPE VALVES

- A. Valves for HDPE water mains shall be polyethylene ball valves suitable for use with piping complying with AWWA C901 and AWWA C906 as applicable.
 - 1. Valves 2-inches and smaller shall have an integral stainless steel valve stem. Valves larger than 2-inches shall have polyethylene valve stem.
 - 2. Valve body shall be fully fused with no metal internal parts.
 - 3. Valve shall provide full port through opening, with no flow obstructions, when in open position.
 - 4. Valves shall be rated for full pressure rating of connecting pipe, 160 psi minimum.
 - 5. Install valves shall using butt-fusion.
- B. Valves shall be NSF certified for use with potable water.
- C. Manufacturer: Polyvalve, Poly-Water Valves or approved equal.

2.6 TRACE WIRE – NOT USED

2.7 DETECTABLE WARNING TAPE

- A. Warning tape must not be less than five (5) mil, foil backed, six inches (6”) wide vinyl tape, colored blue, with “Caution Buried Water Line Below” continuously printed in black along the tape length.

2.8 THRUST RESTRAINT SYSTEM - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Determine exact location and size of piping and appurtenances from Drawings; obtain clarification and directions from Engineer prior to execution of work.
- B. Verify invert elevations of piping prior to installation of piping.

3.2 JOINTING METHOD (BUTT FUSION)

- A. HDPE pipe shall be joined with butt, heat fusion joints as outlined in ASTM D2657 and conform to the Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe, Technical Report TR-33/2012, published by the Plastic Pipe Institute (PPI) unless otherwise authorized by Engineer. All Joints shall be made in strict compliance with the manufacturer’s recommendations. Personnel performing butt fusion of HDPE pipe shall be certified in the procedure by a representative of the fusion machine manufacturer.

- B. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipes so joined shall be made from the same class and type of raw material made by the same raw material supplier. Pipe shall be furnished in standard laying lengths not to exceed 50-feet.
- C. On days butt fusions are to be made, the first fusion shall be inspected by a certified installer and document:
 - 1. Heating surfaces shall be inspected for cuts and scrapes and shall be free of dirt and residue. Heater surfaces should be between 400°F (minimum) and 450°F (maximum). Measure the temperature at 12:00, 3:00, 6:00, and 9:00 o'clock positions using a pyrometer or infrared thermometer at locations where the heating plate will contact the pipe/fitting ends. The maximum temperature difference between any two points on a single heating surface must not exceed 24°F. If this temperature is exceeded, the heating plate shall be cleaned per the manufacturer's recommendations.
 - 2. The joint shall be photographed and inspected as to continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e. – joint shall have visible molded material between walls of pipe). Joint spacing between the walls of the two ends shall be a minimum of 1/16" to a maximum of 3/16".
 - 3. The first joint shall be labeled with the Station and Date. The information shall be visible in the photograph.
- D. The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resistant bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly.

3.3 INSTALLATION

- A. High Density Polyethylene (HDPE) Pipe shall be installed in accordance with the manufacturer's instructions, as shown on the Drawings and as specified herein. A certified joining technician shall perform all heat fusion joints.
- B. Care shall be taken in loading, transporting and unloading to prevent damage to the pipe. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before installation and no pieces shall be installed if found to be defective. Any damage to the pipe shall be repaired as directed by the Engineer. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor at his own expense.
- C. Care shall be taken during transportation of the pipe such that it will not be cut, kinked, or otherwise damaged.
- D. Ropes, fabric or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.
- E. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will

not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

- F. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 5 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.
- G. Pipe shall be laid to lines and grade shown on the Drawings.
- H. Contractor shall work around, support and protect existing raw water system as required to complete the Work.
- I. Contamination Prevention:
 - 1. Contractor shall take particular care to keep potential sources of contamination from collecting around water mains and services.
 - 2. Adequate provisions shall be made to direct surface flows and other sources of potential contamination away from the work area during construction.
 - 3. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means.
- J. Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.
- K. The pipe shall be joined by the method of thermal butt fusion, as outlined in these specifications. All joints shall be made in strict compliance with the manufacturer's recommendations.
- L. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:
 - 1. A polyethylene flange shall be thermally butt-fused to the stub end of the pipe.
 - 2. A 316 stainless steel back up ring shall mate with a 316 stainless steel flange.
 - 3. 316 stainless steel bolts and nuts shall be used.
- M. Flange connections shall be provided with a full-face neoprene gasket.
- N. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

3.4 TRACE WIRE FOR NON-METALLIC PIPE – NOT USED

3.5 CLEANING AND FLUSHING

- A. Upon completion of pipe laying, prior to pressure testing or disinfection, all dirt and foreign material shall be removed by open bore flushing through unrestricted outlets.
- B. Flushing velocities shall be a minimum of 3 feet per second. All flushing shall be coordinated with the Engineer. Debris cleaned from the lines shall be removed from the job site.
- C. The Contractor shall furnish, install, and remove all fittings and pipe necessary to perform open bore flushing.
- D. Flushing through hydrants or reduced outlets shall not be permitted.
- E. Each section of newly laid pipe between valves or dead ends shall be flushed independently.
- F. Fire hydrants shall be flushed separately after completion of flushing for the parent line.
- G. Flushing shall continue until such time that the Engineer is satisfied the pipe is free of dirt and foreign matter.
- H. No flushing shall be performed without prior approval of the Engineer.

3.6 HYDROSTATIC TESTING

- A. Pressure testing shall be conducted per Manufacturer's recommendations and as approved by the Engineer.
- B. All HDPE mains shall be field-tested. Contractor shall supply all labor, equipment, material, gages, pumps, meters, and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.
- C. All pressure mains shall be pressure tested.
 - 1. Should a leak be found in a section of new piping, the piping shall be repaired at the Contractor's expense.
- D. Pressure testing procedure shall be as follows:
 - 1. Restrain pipeline against movement in event of catastrophic failure. Leave joints exposed for leakage examination.
 - 2. Isolate section of piping to be tested.
 - 3. Fill line slowly with water. Maintain flow velocity less than 2 feet per second.
 - 4. Expel air completely from the line during filling and again before applying test pressure. Air should be expelled by means of taps at points of highest elevation.
 - 5. Pressurize pipeline to a test pressure of 130 psi.
 - 6. When test pressure is applied to a water filled pipe, the pipe expands. Sufficient make-up test water must be added to the system to maintain the test pressure.

7. Maintain maximum test pressure for four (4) hours.
 8. After four-hour expansion phase, stop adding make-up test water and reduce pressure by 10 psi, which then becomes the target test pressure.
 9. The final test pressure shall be within 5% of the target test pressure at the end of one (1) hour.
 10. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the Engineer at the point where the pressure is being monitored.
- E. If the final test pressure is within 5% of the target test pressure at the end of the test period and there are no visual leaks the installed pipe shall be considered to have passed.
- F. All visible leaks are to be repaired regardless of the amount of leakage.
- G. The Contractor shall submit his plan for testing to the Engineer for review and approval at least 10 days before starting testing.
- H. The Contractor shall notify the Engineer a minimum of 48 hours before actually beginning field testing.

3.7 DISINFECTION OF WATER PIPING SYSTEM

- A. Disinfect system in accordance with Section 33 13 00.

3.8 CONTINUITY AND TRACING TESTS – NOT USED

3.9 PROTECTION OF FINISHED WORK

- A. Protect pipe from damage or displacement until pipes straps are installed and secured.

3.10 PLACING SYSTEM IN OPERATION

- A. Upon completion of the work and before its final acceptance, the entire system shall be placed into operation under normal pressure and operated at the pressure for a period of not less than ten (10) days by the Contractor.
- B. Any leaks or defects in the construction of the system which develop during the 10-day period shall be repaired and the test continued until the system is accepted by the Engineer.

END OF SECTION

SECTION 33 13 00
DISINFECTION OF WATER UTILITY FACILITIES AND PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Disinfection of new water wells, raw water pipeline and water treatment plant and testing and reporting results.

1.2 REFERENCE STANDARDS

- A. American Water Works Association
1. AWWA B300: Hypochlorites.
 2. AWWA C651: Disinfecting Water Mains.
 3. AWWA C652: Disinfection of Water Storage Facilities
 4. AWWA C653: Disinfection of Water Treatment Plants
 5. AWWA C654: Disinfection of Wells

1.3 SUBMITTALS

- A. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.
- B. Test Reports: Indicate results comparative to specified requirements.
- C. Disinfection Report:
1. Type and form of disinfectant used.
 2. Date and time of disinfectant injection start and time of completion.
 3. Test locations.
 4. Name of person collecting samples.
 5. Initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
 6. Date and time of flushing start and completion.
 7. Disinfectant residual after flushing in ppm for each outlet tested.
- D. Bacteriological Report:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
 2. Time and date of water sample collection.
 3. Name of person collecting samples.
 4. Test locations.
 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 6. Coliform bacteria test results for each outlet tested.

7. Certify water conforms, or fails to conform, to bacterial standards for potable water.
- E. Water Quality Certificate: Certify water conforms to quality standards of State of Alaska, suitable for human consumption.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651 C652, C653, and C654.
- B. Perform Work in accordance with State of Alaska 18 AAC 80 Drinking Water Standards.

1.5 QUALIFICATIONS

- A. Testing Firm: Company specializing in testing potable water systems, certified by State of Alaska.
- B. Submit bacteriologist's signature and authority associated with testing.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite.
 1. Calcium Hypochlorite shall be comparable to commercial products known as HTH, Perchlolen, or Machochlor, and shall be NSF approved for use in potable water.

2.2 WATER FOR DISINFECTION AND TESTING

- A. Clean, uncontaminated, and potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify wells, raw water transmission line, water treatment plant, and piping system have been cleaned, inspected, and pressure tested.
- B. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.
- C. Confirm to AWWA C651 for pipes and pipelines, AWWA C652 for storage tanks, AWWA C653 for water treatment plants, and AWWA C654 for wells, except as modified in these specifications.
- D. Disinfect the following items installed or modified under this Project, intended to hold, transport, or otherwise contact potable water:
 1. Wells: Disinfect new wells after installation of pumps and connected piping.
 2. Pipelines: Disinfect new raw water transmission line.

3. Water Treatment Plant: Disinfect new filter media, pumps, pipes, valves, and appurtenances. Portions of the existing system may also require disinfection if the new portions of the system cannot be isolated completely.

3.2 DISINFECTION TESTING

- A. Provide and attach required equipment to perform the work of this section.
- B. Inject treatment disinfectant into the beginning of the piping system through a corporation stop inserted in the horizontal axis of the pipe.
- C. Maintain disinfectant in system as required by the AWWA standard in use.
- D. During the chlorination process, all intermediate valves and accessories shall be operated.
- E. Back pressure, causing a reversal of flow in the pipe being treated shall not be allowed.
- F. Flush, circulate, and clean until required cleanliness is achieved.
- G. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

- A. Disinfection, Flushing, and Sampling:
 1. In no instance shall a water line be chlorinated before open bore flushing.
 2. Hydrostatic testing of a water line or equipment containing chlorine solution will not be allowed.
 3. Disinfect system component in accordance with AWWA Standard for the component being disinfected. Use of gas chlorine is not permitted.
 4. Upon completion of retention period required for disinfection, flush pipeline or equipment component until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
 5. Excess chlorinated water:
 - a. Legally dispose of chlorinated water in accordance with 18 AAC 70.
 - b. Dam and contain any accidental discharge of heavily chlorinated liquids.
 - c. Prior to discharge of chlorinated water to surface water, wetlands or sewers, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
 - d. Disposal into the sewer system shall be approved by the agency having jurisdiction and only at a rate of disposal that does not overload the sewer.
 - e. When necessary, federal, state and local regulatory agencies should be contacted by the Engineer to determine special provisions for the disposal of heavily chlorinated water.
 6. Coliform Testing:

- a. Conduct coliform testing after final flushing and before new equipment is connected to existing system, or placed in service.
 - b. The Contractor shall obtain sterilized sample bottles and/or instructions from the laboratory where the sample bottles will be tested.
 - c. The Contractor shall collect all samples for the bacteriological tests under the direct supervision of the Owner or Engineer.
 - d. Collect two sets of acceptable samples, taken twenty-four (24) hours apart, of water from each section of the disinfected piping, each individual well, and treatment equipment.
 - 1) For new pipelines, sets of samples shall be collected every 1,200 ft of new water line, plus one set from the end of the line.
 - e. A satisfactory report certifying that the water quality is suitable for human consumption, shall be received from an independent state certified laboratory on bacteriological samples collected from representative points in the new water system as required by state regulations.
 - f. Do not place water treatment plant, or piping in service until water testing certifies that water quality is suitable for human consumption.
7. If testing indicates water is not suitable, Contractor shall re-disinfect the system and retest until suitable results are obtained.

END OF SECTION

SECTION 33 42 13

PIPE CULVERTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm drainage piping and culverts.
2. Accessories.
3. Underground pipe markers.
4. Bedding and Backfill materials.

B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 23 16 – Excavation and Trenching
3. Section 31 23 19 - Dewatering.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M196 - Corrugated Aluminum Pipe for Sewers and Drains.
2. AASHTO M198 - Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.
3. AASHTO M206 - Reinforced Concrete Arch Culvert Storm Drain, and Sewer Pipe.
4. AASHTO M207 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.
5. AASHTO M252 - Corrugated Polyethylene Drainage Tubing.
6. AASHTO M294 - Corrugated Polyethylene Pipe, 12- to 36-in Diameter.

B. ASTM International:

1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
2. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

3. ASTM F405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
4. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
5. ASTM F667 - Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, pipe accessories.
- C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Block individual and stockpiled pipe lengths to prevent moving.
- B. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- C. Do not place pipe flat on ground. Cradle to prevent point stress.
- D. Store UV sensitive materials out of direct sunlight.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

- A. Corrugated Metal Pipe: Meet the following requirements for conduits and coupling bands including special sections such as elbows and flared end sections.
 1. Material Types
 - a. Steel: Shall meet the requirements of AASHTO M-36
 - b. Aluminum: Shall meet the requirements of AASHTO M-196

2. Meet the specified dimensions and gages.
 - a. Diameter as shown on the Drawings
 - b. 16 gage for pipe, end sections and accessories for diameters less than 24-inches.
 3. Joint Couplings:
 - a. Corrugated to match the index in the pipe corrugations
 - b. Width: not less than 3/4 of the nominal pipe diameter.
 - c. Couplings shall be manufactured to lap equally to a distance on each jointed pipe, to no less than the diameter of the pipe
 - d. Couplings shall provide a positive means of closure.
- B. Corrugate Polyethylene Pipe: Meet the following requirements for conduits and coupling bands including special sections such as elbow and flared end sections.
1. Meet the specified requirements based on sizes:
 - a. Diameters three inch through ten inch (3" to 10") shall meet requirements of AASHTO M-252
 - b. Diameters twelve inch (12") and larger shall meet requirements of AASHTO M-294.
 2. Fittings: Shall be rotational of blow molded and shall conform the fitting requirements of AASHTO M-252 or M-294
 3. Joint Connections:
 - a. Corrugated to match the index in the pipe corrugations.
 - b. Pipe diameters measuring three inch to ten inch may use push-on couplings with locking devices or couplings corrugated to match the pipe corrugations.
 - c. Width: not less than 3/4 of the nominal pipe diameter.
 - d. Couplings shall be manufactured to lap equally to a distance on each jointed pipe, to no less than the diameter of the pipe.
 - e. Couplings shall provide a positive means of closure.

2.2 ACCESSORIES

- A. Geotextile Fabric: Conform to Section 31 34 19.

2.3 UNDERGROUND PIPE MARKERS

- A. Detectable Warning Tape: Colored green, "Caution Buried Storm Drain Below" continuously printed in black along length of tape, minimum 6 inches wide by 5 mil thick, foil backed, manufactured for direct burial service.

2.4 BEDDING AND BACKFILL MATERIALS

- A. Bedding: Selected Material, Type D1 as specified in Section 31 05 13.
- B. Backfill: Selected Material, Type B as specified in Section 31 05 13.

PART 3 EXECUTION**3.1 PREPARATION**

- A. Correct over excavation with Selected Material, Type B as specified in Section 31 05 13.
- B. Remove large stones and other hard or organic matter capable of damaging piping or impeding consistent backfilling or compacting.

3.2 EXCAVATION

- A. Excavate pipe trench in accordance with Section 31 23 16 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions to preserve final grades at bottom of excavation.
- C. Provide sheeting and shoring in accordance with Section 31 23 16.

3.3 BEDDING

- A. Exert due care while placing bedding material.
- B. All placement of bedding and compaction shall be per the manufacturer's recommendations or as approved by the Department.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance the manufacturer's recommendations and ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings, variance of individual pipe sections from established line and grade shall not be greater than those listed below:

Allowance Diameter (inches)	Tolerance (feet)
≤12	0.03
14	0.04

16	0.04
≥18	0.05

- C. The alignment of the installed pipe shall appear straight to visual observation and shall be such that a full circle of light can be seen between ends, etc., when sighting along all points of the pipe circumference.
- D. Install pipe to have uniform bearing along entire length of pipe.
- E. Do not lay pipe in wet or frozen trench.
- F. Pipe laying shall in all cases proceed upgrade.
- G. Keep pipe and fittings clean until work is completed and accepted by the Owner. Cap open ends during periods of work stoppage.
- H. Install detectable warning tape continuous over top of pipe at 6 inches above pipeline.

3.5 BACKFILLING

- A. Backfill in accordance with Section 31 23 23.

3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Control.

3.7 PROTECTION OF FINISHED WORK

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is complete.
 - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
 - 2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION

SECTION 33 90 10**PRE-INSULATED ARCTIC PIPE AND FITTINGS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Raw water main piping.
- B. Work Description:
 - 1. The Contractor shall supply insulated pipe and fittings for use in water applications.
 - 2. The minimum service temperature range of all individual components and final products shall be -60 to 100°F unless otherwise specified.
 - 3. All pipe and fittings shall be capable of withstanding the cyclic freezing of water under its rated service pressure without breaks, leaks, gross deformities or impaired service characteristics.
 - 4. Arctic pipe and fittings shall consist of an HDPE core pipe insulated with polyurethane insulation and protected with an outer jacket of either aluminum pipe or HDPE, as specified in the Drawings.
 - 5. To the extent practical, insulated pipe should be supplied in continuous 40-foot lengths to reduce the number of pipe joints and joint kits on long runs.
- C. Related Requirements:
 - 1. Section 331113 – Public Water Utility Distribution System

1.2 REFERENCE STANDARDS

- A. ASTM International
 - 1. ASTM C177 Thermal transmission (guarded hot-plate apparatus)
 - 2. ASTM C273 Shear properties of sandwich-core materials
 - 3. ASTM C518 Thermal transmission (heat flow meter apparatus)
 - 4. ASTM D1248 Polyethylene (PE) extrusion materials – wire and cable
 - 5. ASTM D1599 Resistance to short-time hydraulic failure pressure of plastic pipe, tubing, and fittings
 - 6. ASTM D1621 Compressive properties of rigid cellular plastics
 - 7. ASTM D1622 Apparent density of rigid cellular plastics
 - 8. ASTM D2126 Response of rigid cellular plastics to thermal humid aging (thermal dimensional stability)
 - 9. ASTM D2657 Heat Joining Polyolefin Pipe and Fittings
 - 10. ASTM D2837 Obtaining pressure design basis for thermoplastic pipe products

11. ASTM D2842 Water absorption of rigid cellular plastics
 12. ASTM D3350 Specification for Polyethylene Plastic Pipe and Fittings Materials
 13. ASTM E96 Water vapor transmission of rigid cellular plastics
 14. ASTM E398 Water vapor transmission rate of sheet materials (dynamic relative humidity measurement)
 15. ASTM F714 Polyethylene (PE) plastic pipe (SDR-PR) – based on outside diameter
- B. American Water Works Association
1. AWWA C901 Polyethylene Pressure Pipe and Tubing, 1/2 inches through 3 inches for Water Service
 2. AWWA C906 Polyethylene Pressure Pipe and Fittings, 4 inches through 63 inches for Water Distribution and Transmission
- C. National Sanitation Foundation
1. NSF/ANSI-61 Drinking Water System Components-Health Effects
 2. NSF/ANSI-372 Drinking Water System Components-Lead Content
- D. Plastic Pipe Institute
1. PPI TR-4 HDB/HDS/SDB/PDB/MRS Listed Materials
 2. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe

1.3 SUBMITTALS

- A. The Contractor shall furnish to the Engineer for approval electronic copies of the submittals indicated below. No work shall commence on any item until the required shop drawing submittals have been approved. The submittals shall include:
1. Product Data: Submit manufacturer's standard printed information and literature for all materials to be incorporated in the work.
 2. Shop Drawings: Submit dimensionally correct (scaled) shop drawings for all items to be fabricated prior to beginning fabrication.
 3. Fabrication Procedures: Submit a written description of the methods/procedures to be used in fabricating the pipe and fitting.
 4. Inspections and Testing of Pipe and Fittings:
 - a. Submit proposed hydrostatic testing procedure for review and approval before any testing is undertaken.
 - b. Submit results of foam insulation density and K-value tests performed in the shop on daily basis for all specified inspections and testing of pipe and fittings.
 5. Quality Assurance program in accordance with Article 1.4, below.

1.4 QUALITY ASSURANCE

- A. The manufacturer shall be experienced and regularly engaged in the production of pre-insulated piping systems. The manufacturer shall understand the system design and its intent

and shall produce components suitable to accomplish that intent. Any deficiencies in the Drawings or these Specifications which may jeopardize the performance of the system shall be brought to the immediate attention of the Engineer, prior to submittal of product description and information for acceptance, whenever possible.

- B. The manufacturer shall have and demonstrate the competency and facilities to perform the following standard tests on a daily basis in or sufficiently near the shop where the arctic piping and fittings are being manufactured for this Project:
 - 1. Hydrostatic pressure testing of piping and fittings.
 - 2. Foam density of insulation.
 - 3. K-value.
- C. Engineer shall have open access to the fabrication facility and any sub-tier suppliers to assure conformance with the Specifications and quality of workmanship.
- D. The Contractor shall submit to the Engineer for approval a Quality Assurance program which incorporates as a minimum the following:
 - 1. A description of the method of manufacture.
 - 2. Shop drawings (for review).
- E. The Contractor shall implement the Quality Assurance program to assure compliance with all requirements of this Specification.
- F. A record of all tests which were performed shall be provided to the Engineer as required. (As a minimum, all test reports shall be submitted to the Engineer upon completion of work).
- G. Where a method of testing has not been specified, the Contractor shall submit detailed test procedures for approval by the Engineer.
- H. Any deficiency found in a segment of pipe shall be cause for rejection of the entire segment of pipe. All rejected pipe shall be replaced by the Contractor at no additional cost to the Owner.
- I. All insulated pipe and fittings supplied under this Specification shall utilize the same manufacturer of core pipe. Contractor shall identify the core pipe manufacturer with his submittal.

PART 2 - PRODUCTS

2.1 CORE PIPE

- A. All core pipe shall be made of high-density polyethylene (HDPE) that conforms to all applicable provisions and requirements of the latest revision of AWWA C901 and AWWA C906 and, by inclusion, all appropriate standards referenced therein.
- B. All HDPE pipe shall be National Sanitation Foundation (NSF) listed for contact with potable water.

- C. HDPE Core Pipe Materials: HDPE compounds utilized in the manufacture of products furnished under this Specification shall be listed in PPI TR-4 and have:
1. A grade of PE34 with a minimum cell classification of PE 345444.
 2. Composition class C {which specifies black (weather resistant) pipe containing not less than 2% carbon black} for PE 3408 materials, as defined in ASTM D3350.
 3. In conformance with AWWA C901 and AWWA C906, they shall have a PPI-recommended Hydrostatic Design Basis (HDB) of 160 psi (PE3408) at a temperature of 73°F.
 4. All materials shall be evaluated, tested and certified for conformance with NSF/ANSI-61.
 5. If rework compounds are required, only those generated in the Manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
- D. HDPE Core Pipe Strength, Size and Geometry: Core HDPE pipe and fittings shall conform to standard iron pipe size (IPS) outside dimensions as specified in the Drawings, have a wall thickness meeting SDR 11 or SDR 17, and have a minimum pressure rating of 160 psi for SDR 11 and 100 psi for SDR 17, according to ASTM D2837 at 73 °F with a service rating of 0.5.
1. Water main and pressure sewer force main: SDR 11 minimum.
 2. Sewer gravity main and services, and water service carrier pipe: SDR 17 minimum.
 3. Dimensions and workmanship shall be as specified by ASTM F714. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
 4. HDPE pipe and accessories 4-inch diameter and larger, shall have a Standard Dimension Ration (SDR) of 11 and be pressure rated to a minimum of 160 psi.
 5. HDPE pipe spool sections shall be produced from straight sticks of pipe. Under no circumstances shall any coiled HDPE pipe be used to manufacture products furnished under this Specification.
 6. Core sewer pipe shall be black, stamped with the appropriate SDR and ASTM designations.
 7. Core HDPE pipe and fittings shall be homogeneous throughout, free of visible cracks, holes, foreign inclusions, blisters, dents, or other injurious defects, and shall be made of materials having the same chemical and physical characteristics.
 8. HDPE pipe ends shall be free from chips, gouges, and other damage.
 9. HDPE pipe and fittings shall be designed for direct pipe-to-pipe or pipe-to-fitting thermal butt fusion or for push-on type sewer couplings as specified on the Drawings.
 10. Bell ends of all core pipe and fittings shall be fabricated with identical PVC push-on type sewer couplings. All PVC sewer couplings shall be manufactured in one piece of injection molded PVC compound meeting ASTM D1784. Couplings shall be Class 200 and conform to requirements of DR 21. Fittings shall be designed to withstand a minimum of 630 psi quick burst pressure at 73°F, tested in accordance with ASTM D1599. Bells shall be gasketed joints conforming to ASTM D3139 with gaskets conforming to ASTM F477.

11. The gaskets on push-on couplings shall be elastomeric, non-circular in cross-section, tapered on the inlet edge to prevent rollout when the pipe is coupled, and be not less than 1/4-inch square in the cross-sectional area. The groove in which the gasket is retained shall have sides that are perpendicular to the center line of the pipe.
 12. The spigot end of the core pipe shall be smoothly beveled to a 15 degree angle as shown in the drawings. The bevel shall reduce the wall thickness at the end of the pipe by 50 percent. The bell and spigot ends shall be free from chips, gouges, and other damage. The bell couplings shall not be ground, chipped, gouged, or damaged in any manner.
- E. HDPE Fittings: HDPE (core pipe) fittings shall be manufactured to be as strong as or stronger than the pipe to which the fittings will be joined, shall maintain identical IPS outside dimension on stub-outs, and shall conform to the minimum pressure rating listed above.
1. Fittings shall be manufactured from NSF/ANSI-61-certified components.
 2. Wyes shall be constructed using a prefabricated reinforced fitting constructed with thickened sidewalls and an inside diameter that matches SDR 11 or SDR 17 pipe.
 3. HDPE fittings shall have a PPI-recommended HDB of 160 psi at a temperature of 73.4°F. No pressure de-ratings shall be allowed unless explicitly allowed by the ENGINEER.
- F. HDPE Elbows: HDPE (core pipe) elbows between 2 and 8 inches in diameter shall be fabricated using sweep bends.
1. Sweep bends shall be seamless, manufactured in one continuous piece of SDR 11 HDPE pipe, with an angular tolerance of + 2 degrees without reversion and shall have a bend radius as specified in the following table.
 2. Elbows shall not be mitered and fused.
 3. Elbows shall maintain normal outside diameters along their entire length within tolerance as per ASTM F714 and be suitable for butt-welding or electrofusion.
 4. The outside surface of the elbows shall exhibit all the specified characteristics of the straight pipe and shall not have any blisters or other surface defects from the manufacturing process.
 5. Sweep bends shall be NSF/ANSI-61 certified after manufacture of the final product.
 6. Tight-radius 90-degree elbows shall be constructed with molded fittings rated at the minimum pressure listed in Article 2.01C above, and shall be NSF/ANSI-61 certified.
 7. HDPE sweep fittings shall have a PPI-recommended HDB of 160 psi at a temperature of 73°F. No pressure de-ratings shall be allowed unless explicitly allowed by the Engineer.
- G. The manufacturer of fabricated fittings supplied under this Specification shall establish and qualify heat fusion procedures conforming to PPI TR-33 and ASTM D2657. Fusion shall be performed by a factory-certified operator qualified in the use of the specific equipment employed to construct the fittings.

2.2 PIPE IDENTIFICATION

- A. The following shall be continuously indent printed on the pipe or spaced at intervals not exceeding 5-feet.
1. Name and/or trademark of the pipe manufacturer.

2. Nominal pipe size.
3. Dimension ratio.
4. The letters PE followed by the polyethylene grade in accordance with ASTM D1248 followed by the hydrostatic design basis of the piping.
5. A production code from which the date and place of manufacture can be determined.

2.3 METAL OUTER JACKET

- A. Applies to above-grade portions of the raw water line.
- B. Metal outer jackets for pipe and fittings shall be constructed of 16-gauge internal helical lock-seam corrugated aluminum pipe with nominal diameters as indicated on the Drawings.
 1. Aluminum alloy material shall be 3004-H34 with a 7072 coating on the outside of the jacket or 5052-H32.
 2. All helical seams shall be continuous, tightly locked and folded. The outer jacket of all pipe and fittings shall be watertight under a five-foot head of water.
- C. Outer jacket corrugations shall be between 3/16 inches and 3/8 inches deep, as measured from the flat area between corrugations to the bottom of the corrugation on the outside of the jacket. Corrugations shall be spaced no more than 2-2/3 inches apart and formed diagonally around the pipe, resulting in not less than 2 nor more than 10 complete corrugations crossing the pipe's circumference at a given cross section.
- D. The nominal diameter shall be the inside diameter as measured between the innermost portion of the corrugations, with a dimensional tolerance of +1/2 inches.
- E. All joints in the aluminum outer jacket fabricated around fittings shall be push-on type, welded with a continuous bead, resulting in a finished jacket that is watertight per the requirements of Article 2.2A above.
- F. The Contractor shall provide manufacturer's name and production date (month and year) on the outer jacket of each pipe and fitting. Information shall be engraved on aluminum jackets with 1/8-inch to 1/4-inch high lettering within 24 inches of one end of the jacket.
- G. All surfaces of the outer jacket, including end-cuts and welds, shall be finished such that no jagged edges exist that could cause personal injury.
- H. The interior of the jacket shall be free of oils, grease, or other residue that could interfere with the adhesion of insulation to the outer jacket.
- I. Outer jacket shall be Spir-L-Lok aluminum, or approved equal, unless otherwise shown on the Drawings.

2.4 HDPE OUTER JACKET

- A. Applies to below-grade portions of the raw water line.
- B. HDPE jacket shall be high-density polyethylene, conforming to ASTM D-1248 and the specification standards listed above for the HDPE core pipe. The wall thickness shall be SDR

32 or a minimum of 175 mils thick. The jacket size nominal diameters shall be as specified on the Drawings. Joints in the HDPE outer jacket for fittings shall be butt fused wherever possible and extrusion welded where required an 80 mil polyurea jacket may be substituted. The outer jacket shall be finished to produce a watertight covering.

- C. All joints in the HDPE outer jacket fabricated around fittings shall be welded with a continuous bead, resulting in a finished jacket that is watertight per the requirements above.

2.5 INSULATION

- A. All Federal and State regulations applicable to the type of insulation and its use shall be strictly adhered to.
- B. Urethane foam insulation shall have the following characteristics:
 - 1. The maximum K-factor: 0.155 BTU-in/hr-sf-deg F per ASTM C177.
 - 2. Core Density Range: 30. to 4.0 pounds per cubic foot per ASTM D1622.
 - 3. Minimum Compressive Strength (parallel and perpendicular to pipe axis): 35 psi per ASTM D1621.
 - 4. Maximum Water Absorption: 0.05 pounds per cubic feet per ASTM D2842.
 - 5. Dimensional Stability (maximum linear change): 1% at -20 degree F, and 3% at +100 degree F per ASTM D2126.

2.6 HEAT TRACE CHANNELS

- A. Applies to raw water services to well houses.
- B. Heat trace channels shall be fully enclosed and constructed of PE or ABS material with a minimum thickness of 0.10 inches. The channel shall be in direct contact with the core pipe for its entire length and there shall be no intrusion of insulation between the channel and the core pipe unless otherwise specified.

2.7 FLANGES AND ACCESSORIES

- A. Connection:
 - 1. Type 304, stainless steel or ductile iron backup ring with 125 lb. ANSI B16.1 standard drilling.
 - 2. Flanges shall be completed with one-piece, molded polyethylene stub ends.
 - 3. Flanged connections shall have the same pressure rating as the pipe or greater.
- B. Gaskets: Flat ring, full face, 1/8-inch EPR.
- C. Bolts:
 - 1. Mild steel, ASTM A307, Grade B hex-head bolts; and ASTM A563, Grade B hex-head nuts.
 - 2. Bolts shall be fabricated in accordance with ANSI B18.2 and provided with washers of the same material as the bolts.

2.8 ARCTIC DRAIN

- A. Pre-fabricated Manifold: Fabricate per the Drawings.
- B. Flush valve: 2-1/2 inch right angle, Class ISO, 300 PSI, Potter-Roemer 4065, or approved equal.
- C. Flush hydrant enclosure: Fabricate enclosure from 16 gage sheet metal as detailed in the Drawings.

PART 3 - EXECUTION

3.1 MANUFACTURING AND DIMENSIONAL TOLERANCES

- A. Allowable offset of the centerline of the outer jacket and core pipe shall not exceed ¼ inches at the pipe ends. Elsewhere along pipe lengths the centerline offset shall not exceed 3/8 inches. Allowable offset of the centerline of the glycol trace channel and core pipe shall not exceed 3/8 inches.
- B. The minimum temperature of all components used to manufacture pipe and fittings shall be 50 °F at the start of fabrication. The fabricated pipe shall be placed in a facility maintained at a temperature of 50 °F or greater for a minimum of 12 hours after fabrication.
- C. All elbows shall have a bend radius as specified in the Drawings with a tolerance of + 2 degrees without reversion. All elbows shall maintain normal outside diameters along their entire length without tolerance as per ASTM-F714.
- D. Unless otherwise noted herein or on the Drawings, all fittings shall be constructed utilizing core pipe of the same material, resin, and dimensions as that used for the core pipe of the straight lengths.
- E. Branches of fabricated fittings shall lie in a single plane with a maximum deviation of + 2 degrees.
- F. The length of core pipe protruding from the insulation on the ends shall be 12 inches + 1/4 inches. Core pipe ends shall be smooth and oriented perpendicular to the core pipe longitudinal axis + 1/8 inches.
- G. Outer Jacket:
 - 1. Outer jackets shall be cut in one pass perpendicular to the length of the jacket + 1 degree.
 - 2. The coupling on bell ends shall be perpendicular to the length of the jacket + 1 degree and flush with the jacket end with a tolerance of -1/8 inches.
 - 3. No part of the coupling shall protrude beyond the end of the jacket as determined by placing a straight-edge across the jacket at any two points.
 - 4. The bell end of the coupling shall be flush with the insulation and outer jacket.
 - 5. Before coating, the plane of the exposed insulation face at bell and spigot ends shall be perpendicular to the centerline axis of the outer jacket + 1/8 inches.

6. The insulation profile of the coated ends shall not exceed a relief deviance of + ¼ inches across the face.

3.2 FABRICATED FITTINGS

- A. Fusion joints used in fabricated fittings shall be documented by a computer that records pressure and temperature applied at each fused joint. Computer printouts and electronic data for each fitting shall be made available to the Engineer upon request. Contractor shall ensure that each joint is fused at the temperature and pressure recommended by the pipe manufacturer in order to achieve the maximum pressure rating for that joint.
- B. All fittings for each project shall be labeled with a unique identifier that corresponds with the fusion computer printouts for each fitting.

3.3 INSULATING

- A. Insulation shall be placed into the pipe by a single injection application. Fittings may be manufactured using one insulation injection for each open end of the fitting. In no case shall the jacket be drilled to perform, monitor, or inspect the injection.
- B. Maximum allowable void size is 0.05 in³ (for reference, a 3/8-inch x 3/8-inch x 3/8-inch cube is 0.05 in³).
- C. Insulation and chemicals shall be prevented from coming in contact with the end or inside of the exposed core pipe.
- D. The heat trace channel shall be secured to the outside of the core pipe, parallel to the pipe axis, and prior to insulating. The channel shall protrude 2 inches past the insulation faces at each end of the pipe or fitting, be free of insulation residue and foreign substances, and open to the minimum cross section specified throughout.

3.4 CORE PIPE/INSULATION BOND

- A. Core pipe and fittings shall be bonded to the insulation with minimum shear bond strength of 15 psi, or in such a manner as to produce insulation-to-insulation separation when a sample is tested in shear.
- B. The core pipe surface preparation will be performed in a manner that does not leave foreign material imbedded in the plastic. Gouges or scratches in the pipe surface that exceed the tolerance specified by the pipe manufacturer for the pipe pressure rating shall be cause for rejection.

3.5 PRODUCTION TESTING AND INSPECTION

- A. Only finished pipe lengths and fittings that meet the requirements of these Specifications and Drawings shall be used for destructive testing. Should any product fail to meet the visual quality control specifications listed below, that product shall be either re-built to meet the Specifications or rejected. Only those products that meet all visual quality control specifications shall be considered final products suitable for receipt by the Owner or for laboratory or other destructive testing.
 1. Continuous Visual Quality Control:

- a. Fusion Joints: All fusion joints on elbow and fitting extensions shall be examined before the core pipe assembly is installed into the outer jacket. Elbow and fitting extension fusion joints shall meet all the requirements of the pipe manufacturer and the following minimum requirements:
 - 1) On both sides, the double bead shall be rolled over to the surface and be uniformly rounded and consistent in size throughout the entire circumference of the joint.
 - 2) The gap between the two beads shall not be below the fusion surface throughout the entire circumference of the joint.
 - 3) The displacement (perpendicular to the pipe centerline) between the fused ends shall not exceed 10% of the pipe minimum wall thickness.
 - 4) The width of the combined two beads for SDR 11 pipe shall be as follows:

<u>Pipe Diam.</u>	<u>Minimum Bead Width</u>	<u>Maximum Bead Width</u>
2" pipe	3/16 inches	5/16 inches
3" pipe	9/32 inches	3/8 inches
4" pipe	5/16 inches	7/16 inches
6" pipe	3/8 inches	9/16 inches
8" pipe	1/2 inches	11/16 inches
 - 5) Both beads of each fusion joint shall be of a uniform size and shape. The ratio of the difference in individual bead widths divided by the total width of both beads shall not exceed 10%.
 - b. Dimensional Tolerance: Each length of pipe and each fitting will be examined by the Contractor for off-set tolerances, insulation cut-back distances, exposed insulation face alignment and relief profile, and alignment and smoothness of core pipe ends.
 - c. Insulation Integrity: Completed pipe and fitting ends shall be inspected for voids in excess of 0.05 in³ or discontinuities by the Contractor prior to coating. Any glazing left on the uncoated pipe end from the forms used during the insulating operation shall be removed before coating.
 - d. HDPE Carrier Pipe: The surface of the HDPE carrier pipe shall be free of nicks, cuts, or gouges as outlined in paragraph 2.1 of this document.
2. Testing: On a daily basis, for every 200 LF of arctic pipe manufactured, testing as identified in approved hydrostatic testing procedure shall be conducted to verify the quality of the finished product, and recorded:
 - a. The density and K-factor shall be measured on insulation specimens of the appropriate size and under the specified conditions as set forth in the applicable ASTM test. For these tests, insulation specimens shall be retrieved by cutting a 12-inch section of insulated pipe from a production sample. The remaining length shall be trimmed to the dimensional tolerances of this Specification to allow Owner use of that pipe section.
 - b. Should the Contractor choose to test the "K" factor as outlined in ASTM C518, the testing apparatus shall be calibrated within 24 hours of the test using a calibration

standard certified accurate by the National Bureau of Standards (NBS). The "K" factor test sample shall be removed from the insulated pipe, prepared for testing, and left open to the atmosphere at 70°F for a minimum of 24 hours prior to testing.

- c. Shop hydrostatic testing shall be performed at the factory on all fabricated fittings and welded pipe assemblies in accordance with Article 3.09 below.
- d. In addition to the testing identified in Article 2.02B, and at no additional cost to the Owner, the following laboratory tests shall be performed on every 480 LF of manufactured pipe to verify the quality of the finished product:
 - 1) Core pipe/insulation bond:
 - a) Two 6-inch lengths of cured insulated pipe shall be cut from one uncoated insulation face end of completed pipe length. The remaining length shall be trimmed according to the dimensional tolerances of this Specification and coated to allow Owner use of that pipe section.
 - b) One specimen shall be tested at +70°F. The other specimen shall be brought to -60°F in 4 hours or less, and remain there for at least 24 hours before testing. Acceptance will be indicated by a minimum shear bond strength of 15 psi and insulation-to-insulation (or insulation-to-insulation pipe surface film) separation or tearing.

3.6 PACKING

- A. The core pipe spigot ends of all pipe and fittings shall be capped with PE pipe caps (Caplugs, or approved equal) and the plugs taped to the pipe with black electrical tape (such as 3M #33+) or other approved tape after final inspection and prior to shipment. Duct tape shall not be used to secure the PE pipe caps to the pipe spigot ends.
- B. Pre-insulated pipe shall be packed in bundles with a maximum gross weight of 3,000 pounds per bundle unless otherwise specified by the Owner.
 - 1. The end geometry of each bundle shall be rectangular.
 - 2. Each layer of pipe within the bundle including the bottom layer shall rest upon a minimum of 3 each 4-inch x 4-inch cross cleats banded to that individual layer using 1 1/4-inch steel strapping.
 - 3. All cleats shall feature a 45-degree stop block at least nominal 4 inches high by 4 inches long fastened securely to both ends of the cleats to prevent the pipe from rolling off the cleat when the banding is cut.
 - 4. The outer cross cleats shall be installed between 1 to 2 feet from the insulation face of the pipe ends with the middle cleat centered on the bundle. In addition, 1 1/4-inch steel straps shall securely fasten all the layers together to form a complete bundle.
- C. Fittings and couplings shall be packaged in crates sheathed with minimum 1/2-inch sheathing not to exceed 4 ft x 4 ft x 8 ft.
 - 1. Minimum nominal 2-inch x 3-inch framing members shall be installed in all corners of the crate and fastened securely to the sheathing.
 - 2. On crates longer than 6 feet, framing members shall be installed along the shorter centerline of all the 4 long panels. The framing members shall be securely fastened to each other and to the sheathing.

3. For crates 4 feet long or less, 2 each, 4-inch x 4-inch cleats shall be installed on the bottom edges of the crate to provide for forklift handling.
 4. For crates longer than 4 feet, 3 cleats shall be installed, with the middle cleat centered on the crate. These cleats shall be fastened through the bottom sheathing and also banded to the crate with 1 1/4-inch wide steel bands that wrap around the entire crate.
 5. Crates shall be designed to stack 3 crates high and protect contents during rough ocean conditions, air freight transport, and on-site handling without damage.
- D. All bundles and crates shall be clearly marked with the following information:
- CITY OF UNALAKLEET, ALASKA
UNALAKLEET WATER & SEWER PROJECT**

3.7 INSPECTION

- A. After completion of the quantity of pipe and fittings contracted for, the Owner may perform a final inspection at the fabrication point. The certified results of all required laboratory tests made during production by the Contractor shall be made available in report form at this time.
- B. During the final inspection, the product packing will be inspected to see that all requirements listed above have been met. Should any of the packing fail to meet the Specifications, the Contractor shall re-pack the pipe to meet the Specifications.

3.8 INSTALLATION

- A. Methods:
 1. Install and cut HDPE pipe in accordance with ASTM D2657, thermal butt-fusion, and in strict conformance with the manufacturer's recommendations.
 2. Contractor may install piping in pre-manufactured sub-assemblies of any length and configuration that can be safely handled without damaging the piping or endangering personnel.
- B. Butt Fusion Jointing:
 1. Perform butt fusion in accordance with the procedures established by the pipe manufacturer
 2. Perform butt fusion joining of pipe and fittings on fusion machinery approved by the pipe manufacturer.
 3. Fusion pressures, temperatures and cycle times shall be provided according to pipe manufacturer's recommendations.
 - a. Fusion processes shall be properly tented, heated and otherwise protected from wind and rain.
 - b. Fusion pressures, temperatures and cycle times shall be recorded for every joint, and made available for the Engineer's review upon request.
 4. Do not allow any individual to fuse pipe or fittings unless they are factory-trained and certified in the technique involved.

5. Butt fusion is the preferred method of joining HDPE pipe ends and shall be used where possible. Do not use electrofusion couplings unless specifically shown in the Drawings and approved by the Engineer.
- C. Insulation and Jacket Jointing:
 1. Fit heat trace channel in place, ensuring that ends are de-barred and square to allow easy passage of the electrical trace.
 2. Fit insulation half-shells snugly. Band with strapping to hold tightly in place. Maximum gap in half-shells shall be 1/8-inch.
- D. Place mastic evenly over the entire surface of the insulation; ensure that the mastic has sealed all mating surfaces.
 1. Material shall be "Lion Oil Seal Kote Retardant" (no flash), or approved equal.
 2. Coating shall be applied with a thickness of 15 to 63 mils.
- E. Joint Jacket: Install per manufacturer's recommendations employing a silicone sealant, rated to -60 F, on all seams.

END OF SECTION

DIVISION 40 PROCESS INTEGRATION

SECTION 40 05 50
PROCESS VALVES AND PIPING APPURTENANCES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. Ball Valves
 - 2. Butterfly Valves
 - 3. Solenoid Valves
 - 4. Manual Operators
 - 5. Accessories
- B. Related Sections:
 - 1. Section 01 33 00: - Submittals Procedures.
 - 2. Section 40 23 00 –Process Piping

1.2 REFERENCES

- A. Referenced Standards: To the extent referenced in this specification section, the standards and documents listed below are included, and made a part of this Specification. In the event of a conflict, the requirements of this Specification section prevail. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.
- B. American Water Works Association (AWWA):
 - 1. B100, Granular Filter Media.
 - 2. B300, Standard for Hypochlorites.
 - 3. C230 Full-Encirclement Repair and Service Connection Clamps.
 - 4. C500 Gate Valves for Water and Sewerage Systems.
 - 5. C504 Standard for Rubber-Seated Butterfly Valves.
 - 6. C508 Standard for Swing-Check Valves for Waterworks Service, 2 in. Through 24 in. NPS.
 - 7. C509 Resilient-Seated Gate Valves for Water and Sewerage Systems.
 - 8. C510 Double Check Valve, Backflow-Preventer Assembly.
 - 9. C511 Required Pressure Backflow-Prevention Assembly.
 - 10. C540 Power-Actuating Devices for Valves and Sluice Gates.
 - 11. C550 Protective Epoxy Interior Coatings for Valves and Hydrants.
 - 12. C606 Grooved and Shouldered Joints.
 - 13. C653, Disinfecting Water Treatment Plants.
 - 14. C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 15. C110, Ductile-Iron and Gray-Iron Fittings for Water.
 - 16. C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 17. C116, Protective Fusion-Bonded Epoxy Coatings for Interior and Exterior Surfaces of Ductile-Iron Pipe.
 - 18. C151, Ductile-Iron Pipe, Centrifugally Cast, for Water.

19. C153, Ductile-Iron Compact Fittings for Water Service.
20. C900. Poly Vinyl Chloride (PVC) Pressure Pipe, 4 Inch through 12 Inch, for Water
21. M20, Water Chlorination / Chloramination Practices and Principles.

C. American National Standards Institute (ANSI):

1. B16.1 Cast Iron Pipe Flanges and Flanged Fittings.
2. C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. A21.11 Rubber Gasket Joints for Ductile - Iron and Grey Iron.
4. B1.20.1 Valve and Connections (Threaded).
5. B16.18 Valve and Connections (Soldered).
6. B16.11 Forged Steel Fittings, Socket-Welding and Threaded.
7. B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.
8. B16.24 Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300.
9. B16.25 Butt-Welding Ends.
10. B16.5 Pipe Flanges and Flanged Fittings.
11. A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

D. ASTM International (ASTM):

1. A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. B32, Standard Specification for Solder Metal.
3. B88, Standard Specification for Seamless Copper Water Tube.
4. B813, Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
5. C828, Low Pressure Air Test.
6. D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
7. D1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
8. D2464, Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
9. D2467, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
10. D2564, Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems.
11. D2846, Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
12. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
13. F594, Standard Specification for Stainless Steel Nuts.
14. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

E. National Sanitation Foundation (NSF):

1. Standard 14, Plastics Piping System Components and Related Materials.
2. Standard 60, Testing and certification for drinking water treatment chemicals.
3. Standard 61, Testing and certification for drinking water system components.

F. International Plumbing Code (IPC).

G. Underwriters Laboratories, Inc. (UL).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product technical data including:

1. Documents identifying any deviations and the Engineer's acceptance, or corrective work.
2. Quotations with matched product cut sheets for all valve types and piping appurtenances.
3. Acknowledgement that products submitted meet requirements of standards referenced.
4. Manufacturer's installation instructions.

D. Closeout Submittals:

1. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals. See Section 01 70 00 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.
2. Record Drawings: Record Drawings shall be prepared showing the "as-built" locations and dimensions of the work.

PART 2 PRODUCTS

2.1 GENERAL

- A. All pipe, fittings, equipment and appurtenances in contact with potable water shall conform to NSF International Standard 61 or the health effects portion of NSF Standard 14.
- B. Pipe sizes are nominal iron pipe size diameters unless otherwise noted. All sizes of pipe shall be as indicated. Clearly mark pipe and fittings delivered to the job site to identify the material, class, thickness, and manufacturer. All material shall be new and free of blemishes or defects.
- C. Valve Schedule in the drawings indicates which valve types shall be used in each location.

2.2 BALL VALVES

- A. 2 Inches and Smaller for General Water and Air Service: Bronze, Low lead compliant, NSF 61 Annex G Certified, end entry type, PTFE packing, hand lever operator, rated 150 pound SWP, 600 pound WOG.
1. Manufacturers:
 - a. Milwaukee; UPBA100/150, use 100 for threaded end, 150 for solder end.
 - b. Nibco; T/S-580-80-LF, use T for threaded, S for solder
 - c. Apollo; 77CLF-A
 - d. Watts; LFB6080G2-SS, threaded, use LFB6081G2-SS for solder ends
- B. PVC Ball Valve 4 Inches and Smaller: Rated 150 psi at 73 degrees F, end entry, double union design, solvent-weld socket ends.
1. Manufacturers:
 - a. ASAHI/America; Type 21 True Union

- b. GF Piping Systems; Type 546
- c. Spears; True Union 2000

C. PVC Vented Ball Valves:

- 1) Rating: 150 psi.
- 2) Body and Trim: Schedule 80 PVC.
- 3) Ends: Screwed union type at both ends. Valve can be removed from the line without installing additional unions.
- 4) Seals: EPDM O-ring
- 5) Operator: Lever handle with built-in lockout mechanism
- 6) Valve shall be a vent design for use in sodium hypochlorite applications where entrapped fluids may form caustic crystalline residues and pressure build up from gas.
- 7) Valve shall have a 1/8-inch vent hole in ball to equalize internal fluid pressures.
- 8) Manufacturers and Products:
 - a) Spears 2000 Industrial True-Union Vented Ball Valve.
 - b) Approved equal.

2.3 BUTTERFLY VALVES

A. Butterfly Valve 3 Inches to 12 Inches

- 1. Valve body shall be cast iron, lug design with extended neck to allow for 2" of piping insulation. A non-corrosive bushing and a self-adjusting stem seal shall be provided. No field adjustment shall be necessary to maintain optimum field performance.
- 2. Disk stem shall be either 316 or 416 Stainless Steel metal design. No part of the stem shall be exposed to the line media.
- 3. Seat shall be tongue-and-groove EPDM seat with a primary hub seal and a molded flange O-ring suitable for weld-neck and slip-on flanges. The seat shall totally encapsulate the body isolating it from the line media and no flange Gaskets shall be required.
- 4. Testing: Valve shall be tested to 110% of the rated pressure.
- 5. Pressure Ratings: Valve shall be rated for bubble-tight shutoff at pressure rating of 150 psig.
- 6. Manual Gear Operator: For heavy duty on-off and throttling service of valves, the Operator shall be self-lubricated for smooth, trouble-free operation. The gear operator shall have a hand wheel for operation. A self-locking worm and worm gear drive holds the valve in the desired position.
- 7. Manufacturers include the following:
 - a. Bray Series 21
 - b. Nibco Series LC-2000
 - c. Milwaukee CL Series-Rev. D
 - d. Or approved equal.

2.4 SOLENOID VALVES

A. Solenoid Valve 1/4 Inch to 2 Inches

- 1. Two-way internal pilot operated diaphragm type, brass body, resilient seat suitable for air or water, solenoid coil molded epoxy, NEMA insulation Class F, 120 volts AC, 60-Hz, unless otherwise indicated. Solenoid enclosure NEMA 250, Type 4 unless otherwise indicated. Size and normal position CLOSED when de-energized as indicated.

2. Minimum operating pressure differential no greater than 5 psig, maximum operating pressure differential not less than 125 psig.
3. Manufacturers and Products:
 - a. ASCO; 8221 Series
 - b. Skinner
 - c. Or approved equal.

2.5 MANUAL OPERATORS

- A. General:
 1. Operator force not to exceed 40 pounds under any operating condition, including initial breakaway. Provide gear reduction operator when force exceeds 40 pounds.
 2. Operator self-locking type or equipped with self-locking device.
 3. Position indicator on quarter-turn valves.
 4. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threader steel reach rods with internally threaded bronze or ductile iron nut.

2.6 ACCESSORIES

- A. Tagging: 1 1/2 inch diameter heavy brass or stainless steel tag for each valve operator, bearing the valve tag number shown on the Valve Schedule.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General
 1. Install all valves, gates, operating units, stem extensions, valve boxes, floor stands, and accessories in accordance with Manufacturer's written instructions and as shown and specified. Any proposed deviations thereof must have the written consent of the Engineer.
 2. Support all valves to avoid undue stresses on the adjoining pipe.
 3. Install all valves, appurtenances and accessories to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators with other systems, equipment, handrails, structural components, and any other items.
 4. Install access doors in finished walls and plaster ceilings for valve access.

3.2 TESTS AND INSPECTION

- A. Field test all valves to the method and test pressure of adjoining pipe either while testing pipelines or as a separate step. See field testing requirements in specification Section 40 23 23 Process Piping.
 1. Test and demonstrate that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, in both directions for two-way valve and applications.
- B. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

- C. Count and record number of turns to open and close valve; account for any discrepancies with manufacturer's data.
- D. Set, verify, and record set pressures for all relief and regulating valves.
- E. Test automatic valves in conjunction with control system testing. Test manual override provisions as applicable.
- F. All backflow preventers shall be tested upon installation.

3.3 TAGGING

- A. Valve tagging shall be performed by Contractor.

3.4 TRAINING

- A. Training shall be conducted in accordance with the requirements of Section 01 70 00 Execution and Closeout.

END OF SECTION

SECTION 40 05 67.36**PRESSURE-REGULATING VALVES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Pressure-sustaining valves.

1.2 REFERENCE STANDARDS

- A. ASME International:
1. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
 2. ASME B1.20.2M - Pipe Threads, 60 deg. General Purpose (Metric).
 3. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
 4. ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
 5. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.
- B. ASTM International:
1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 2. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
 3. ASTM A536 - Standard Specification for Ductile Iron Castings.
 4. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
- C. American Water Works Association:
1. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
- D. NSF International:
1. NSF 61 - Drinking Water System Components - Health Effects.
 2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate with installation of process piping.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer catalog information.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit special procedures and setting dimensions.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statement:
 - 1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of pressure-regulating valves.

1.6 QUALITY ASSURANCE

- A. Materials in Contact with Potable Water: Certified to NSF Standards 61 and 372.
- B. Maintain 1 copy of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish three-year manufacturer's warranty for atmospheric vacuum breaker backflow preventers.
- C. Cavitation Damage: Warrant that valves will not suffer cavitation damage within a three-year period from date of installation when exposed to specified operating conditions.

PART 2 - PRODUCTS

2.1 PRESSURE-SUSTAINING VALVES

A. Manufacturers:

1. Cla-Val Model 50-90 Pressure Sustaining Valve
2. 2-inch Cla-Val 50G-90BVYKC, 15/75 PSI range

B. Substitutions: As specified in Section 016000 - Product Requirements

C. Description:

1. Valve opens on increasing upstream pressure and closes on decrease in upstream pressure to maintain minimum set-point upstream pressure regardless of changing flow rate or varying downstream pressure.
2. Type: Pilot operated.
3. Furnish V-ports for pressure control at low flows.
4. Indicator Rod: Attached to piston for visual position indication.

D. Pilot Valves:

1. Type: Globe.
2. Body: Ductile iron.

E. End Connections:

1. Flanged, Class 150.
- F. Performance and Design Criteria:
1. Flow Rate:
 - a. Maximum: 120 gpm.
 - b. Minimum: 20 gpm.
 2. Downstream Pressure:
 - a. Maximum: 20 psig.
 - b. Minimum: 2 psig.
 3. Set-Point Upstream Pressure:
 - a. 60 psig.
 - b. Range: Field adjustable from near zero to 110 percent.
- G. Materials:
1. Body: Ductile iron, ASTM A536.
 2. Disc and Diaphragm:
 - a. Buna-N rubber.
 - b. Disc Retainer and Diaphragm Washer: Cast iron.
 3. Trim: Bronze.
 4. Stem, Nut, and Spring: Stainless steel.
 5. Packing: PTFE.
 6. Control Piping: Brass with stainless-steel wetted trim.
- H. Interior Coating: Coat cast-iron and ductile-iron surfaces with epoxy coating according to AWWA C550.
- I. Accessories:
1. Externally mounted strainer with cocks.
 2. Isolation valve.
 3. Valve position indicator

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Provide shop inspection and testing of completed assembly.
- C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that field dimensions are as indicated on Shop Drawings.
- C. Inspect existing flanges for nonstandard bolthole configurations or design and verify that new pipe and flanges mate properly.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Thoroughly clean end connections before installation.
- C. Close pipe and equipment openings with caps or plugs during installation.
- D. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

- A. According to manufacturer instructions and local code requirements.
- B. Install with nameplate and test cock accessible.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. After installation, inspect for interferences and proper supports.
- D. Testing:
 1. Hydrostatic: Test each assembled valve, except control piping, hydrostatically at 1-1/2 times rated working pressure for minimum five minutes.

2. Leakage:
 - a. Test each valve for leakage at rated working pressure against closed valve.
 - b. Test Duration: Minimum 15 minutes.
 - c. Permitted Leakage: Zero.
3. Perform functional test on each valve to verify specified performance.
- E. Repair damaged coatings with material equal to original coating.

3.5 CLEANING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Keep interior of valves clean as installation progresses.

3.6 DEMONSTRATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

3.7 ATTACHMENTS

- A. Pressure-Sustaining Valve Schedule:
 1. PSV-101:
 - a. Application: Raw water.
 - b. Flow Rate:
 - 1) Minimum: 20 gpm.
 - 2) Maximum: 100 gpm.
 - c. Pressure:
 - 1) Downstream: 20 psig.
 - 2) Upstream Set Point: 60 psig.

END OF SECTION 400567.36

SECTION 40 23 00 PROCESS PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section covers all pipe and fittings within the Water Treatment Plant.
- B. Refer to Section 33 90 10, Pre-Insulated Arctic Pipe and Fittings for water piping outside of the building.

1.2 QUALITY ASSURANCE

- A. Install piping to meet requirements of local and state codes.
- B. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

1.3 SUBMITTALS

- A. Certificates: Submit manufacturer's certificates of conformance.
- B. Test Reports: Submit certified copies of test reports.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Exercise care in transporting and handling to avoid damage to pipe and fittings.
- B. Store materials on the site so as to prevent damage.
- C. Keep materials clean, dry, and free from deleterious conditions.
- D. Do not store material directly on the ground.
- E. Damaged Pipe: Repair or replace to satisfaction of Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable Federal and State requirements. Provide certification by manufacturer or an accredited certification organization that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 372, and that materials are suitable for contact with drinking water per NSF/ANSI 61.

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Pipe:

1. Schedule 80 PVC: conforming to ASTM D1784 and ASTM D1875 with titanium dioxide for ultraviolet protection.
 2. Solvent Welded: Schedule 80.
 3. Threaded: Schedule 80.
- B. Fittings: Schedule to match pipe. ASTM D2466 or D2467 for socket weld. ASTM D2464 for threaded.
1. Solvent weld except where connection to threaded or flanged valves and equipment may require future disassembly.
 2. Threaded female joints shall be metal reinforced, with Teflon tape thread lubricant.
- C. Flanges and Bolting:
1. Flanges: One-piece, molded hub type PVC flat flange in accordance with fittings above. ASME B16.1, Class 125 drilling.
 2. Bolting: Flat face mating flanges ASTM A193/A193M, Type 316 stainless steel grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads.
 3. Gaskets: Full faced 1/8-inch thick ethylene propylene (EPR) rubber.
- D. Solvent Cement: ASTM D2564 and ASTM F656 primer, chemically resistant to fluid service. Solvent cement and primer shall be listed by NSF 61 for contact with potable water.

2.3 TRANSITION FROM HDPE PIPE

- A. Less than 2-inch and smaller: Polycam threaded transition (aluminum bronze NPT) and threaded PVC adapter.
- B. 2-inch and larger: Victaulic series 2971 Aquamine transition coupling.

2.4 WALL AND FLOOR SLEEVES

1. Configuration and materials as shown in details on Drawings.

2.9 DIELECTRIC SEPARATION

- A. Install non-conducting dielectric connections or barriers wherever jointing dissimilar metals.

2.5 HANGERS AND SUPPORTS

- A. General:
 1. All piping shall be supported in a manner which will prevent undue strain on any valve, fitting, or piece of equipment, and will not over-stress connecting structural members.

2. Pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, and where otherwise shown.
3. Pipe supports and hangers shall not be installed in equipment access areas or overhead hoist runs.

B. Seismic Bracing:

1. Brace all piping 2-1/2-inch inside diameter and larger for structural design criteria listed in the Drawings.
2. Lateral supports for seismic loads shall be provided at all changes in direction.

C. Horizontal Piping:

1. Support with adjustable swivel-ring, split-ring, or clevis type hangers: B-Line B3100, B3171 or B3690; or approved equal.
2. Horizontal piping hanger support rods shall attach to ceiling.

D. Stacked Horizontal Runs:

1. Stacked horizontal runs of piping shall be supported by a channel type metal framing system: B-Line, Unistrut, or approved equal.
2. Wall brackets shall be welded steel wall brackets:
 - a. Welded Steel Wall Bracket; B-Line; Figure B3067.
 - b. Adjustable "J" Hanger; B-Line; Figure B3690.
 - c. Offset Pipe Clamp; Anvil; Figure 103
 - d. Framing Channel Pipe Clamp; B-Line; Figure B2400.
 - e. Or approved equal.
3. No pipe shall be supported from the pipe above it.

E. Vertical Piping:

1. Vertical piping hangers and supports shall be channel and pipe straps manufactured by B-Line, Unistrut, or approved equal.
2. Piping supports for vertical piping passing through floor sleeves shall be galvanized steel riser clamps: Grinnel Figure 261, B-Line Figure 3373, or approved equal.

F. All hangers, rods, clamps, protective shields, metal framing support components, and hanger accessories shall be galvanized, and shall be sized as recommended by the manufacturer to properly support the loads. Sizes shall not be smaller than those indicated on the Plans.

G. Maximum Support Spans: Unless recommended otherwise by the pipe and/or pipe support manufacturer, horizontal pipe support or hanger spacing shall not exceed the spans shown on the Plans.

H. The load rating for connections to structural members shall not be less than that of the hanger rods they support.

I. PVC Pipe:

1. Hanger rod spacing for PVC pipe shall be as shown on the Drawings.
 2. Support rods for horizontal piping shall attach:
 - a. To steel beams with I-clamps.
 - b. To concrete with inserts, or with flanges fastened with flush shells.
 - c. To wood 2-1/2 inches or more thick, with bolts or angle clips.
- J. Standard Hangers and Supports: MSS SP-58 or FS WW-H-171.
1. Type: As required for conditions or as indicated.
 2. Hanger rods: Carbon Steel, ASTM A575.
- K. Manufacturer's Hangers and Supports: Unistrut, B-Line or equivalent.
1. Type: As required for conditions or as indicated.
 2. Metal Framing: Unistrut 1-5/8-inch minimum channel width series or equivalent, continuous slot channel, hot-dipped galvanized to ASTM A123 or A153.
 3. End closures, Joint Covers, Closure Strips, Parts, Screws and Nuts: Electro-galvanized, FS QQ-Z-325 or cadmium plated.

PART 3 - EXECUTION

3.1 INSTALLATION OF INTERIOR PIPE

- A. Complete installation to present neat orderly appearance.
- B. Pipe segments shall be prefabricated and coated prior to installation in order to facilitate construction and to minimize disruption of normal plant operations.
- C. Do not block openings or passageways with piping.
- D. Run piping parallel to walls to building, unless otherwise indicated.
- E. Keep piping free from contact with structure or installed items.
- F. Allow clearances for expansion and contraction of pipe.
- G. Anchor horizontal runs over 50 feet at midpoint to force expansion equally toward ends.
- H. Placement of Vertical Piping:
 1. Secure at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and contents.
 2. Install supports at each floor or vertically at intervals of not more than 10 feet.
 3. If piping is to stand free of support, or if no structural element is available for support during construction, secure in position with wooden stakes or braces fastened to pipe.
- I. Placement of Horizontal Piping:

1. Support at sufficiently close intervals to maintain alignment and prevent sagging.
 2. Install hangers at ends of runs or branches and at each change of direction or alignment.
- J. Support at Equipment: Install to not include strain on equipment during or subsequent to the installation of pipe work.
- K. Provide flexible coupling or union at all connections to equipment to facilitate removal for maintenance.
- L. Provide sufficient support of pipe at locations where flexible hose-type connections are specified.

3.2 FLANGED PIPE INSTALLATION

- A. Install perpendicular to pipe centerline.
- B. Tighten flange bolts so that gasket is uniformly compressed and sealed, using torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
- C. Do not distort flanges.

3.3 THREADED JOINTS INSTALLATION

- A. Threads: Conform to ANSI B1.201, NPT.
- B. Cut threads full and clean with sharp dies. Produce sufficient thread to ensure full engagement when screwed home in fittings.
- C. Ream ends of pipe after threading and before assembly to remove burrs.
- D. Leave not more than three pipe threads exposed at each connection.
- E. Lubricate male threads only with thread lubricant or tape as specified for the piping type.

3.4 PVC PIPE INSTALLATION

- A. Cutting:
 1. Cut pipe with a knife or hand saw.
 2. Make cuts square with pipe.
 3. Remove burrs by smoothing edges with a knife, file, or sandpaper.
- B. Solvent Joints:
 1. Clean joint surfaces.
 2. Coat with solvent cement and join.
 3. Hold joint together until cement takes hold.
 4. Use sufficient cement so that a bead of cement is formed between pipe and fitting at socket entrance.

C. Threaded Joints: Tighten by strap wrench to not more than one full turn beyond hand tight.

3.5 TESTING

A. General:

1. All pipe and fittings shall be pressure-tested as specified herein.
2. The Contractor shall furnish all material, equipment, and labor for testing and retesting the piping system.
3. Each system may be tested as a unit or in sections as directed by the Engineer, but each complete system shall successfully meet the requirements specified herein before acceptance by the Engineer.
4. Should any defects appear in the pipe or fittings, the necessary repair should be made, and the line retested until it shall meet the requirements.
5. The Contractor shall take all necessary precautions to prevent any joints from drawing while the pipelines and their appurtenances are being tested and he shall at his own expense repair any damage to the pipe and their appurtenances or to any other structures resulting from or caused by these tests.
6. The Contractor shall inform the Engineer at least 2 days in advance of the time set for testing the piping system.

B. Water Piping:

1. All piping except drain pipe shall be hydro-statically pressure tested as specified herein.
2. Test pressure for water piping shall be 1.5 times the operating pressure.
3. The test shall be made by closing valves or providing bulkheads or plugs and filling the pipeline with water.
4. Provisions shall be made for release of all air in the lines.
5. Lines may be filled with water some time before testing to allow for absorption of water by pipe or joint material.
6. The test pressure must be maintained a minimum of one hour or sufficiently longer to permit the Engineer to make an inspection of the system.
7. During the test, pipe, fittings and joints shall be completely tight.

C. Low Pressure Air Piping and Fittings:

1. All low pressure air piping, interior and exterior shall be air tested at a pressure of 150 percent of the maximum working pressure of the system or 25 psig, whichever is greater.
2. The test shall be made by closing valves or providing bulkheads or plugs as required. The test pressure must be maintained a minimum of 1 hour or sufficiently long to permit The Engineer to make an inspection of the system. The Contractor shall test all joints in the system with a soapy solution while the line is under test pressure and all joints shall be completely tight.

D. Disinfection: See Section 33 13 00, Disinfection of Water Facilities & Piping.

3.6 PIPE SCHEDULE

<u>Service</u>	<u>Material Group(s)</u>	<u>Comments</u>
Water Treatment Process	1	Socket Weld, Flanged, or Threaded Joints.
Chemical Feed Systems	2	As recommended by coordinating chemical feed system supplier

3.7 PIPE MATERIAL GROUPS**A. Group 1:**

1. Pipe: Polyvinyl chloride, Schedule 80, normal impact, ASTM D1785.
2. Fittings: Polyvinyl chloride, Schedule 80, normal impact, socket solvent-weld joints, ASTM D2467.

B. Group 2:

1. Tubing: Polypropylene or polyethylene
2. Supporting Jacket: Schedule 80 PVC (Group 1)
3. Fittings: Stainless steel or PVC, as recommended by the chemical feed system coordinating supplier.

END OF SECTION

SECTION 40 23 01 PROCESS SPECIALTIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section covers special equipment within the Water Treatment Plant.

1.2 QUALITY ASSURANCE

- A. Install piping to meet requirements of local and state codes.
- B. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

1.3 SUBMITTALS

- A. Certificates: Submit manufacturer's certificates of conformance.
- B. Test Reports: Submit certified copies of test reports.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Exercise care in transporting and handling to avoid damage to pipe and fittings.
- B. Store materials on the site so as to prevent damage.
- C. Keep materials clean, dry, and free from deleterious conditions.
- D. Do not store material directly on the ground.
- E. Damaged Pipe: Repair or replace to satisfaction of Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable Federal and State requirements. Provide certification by manufacturer or an accredited certification organization that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 372, and that materials are suitable for contact with drinking water per NSF/ANSI 61.

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS (PV-101)

- A. Construction: Full Acceptance tank constructed of welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 150 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- B. Accessories:
 - 1. Pressure gage and air-charging fitting.
 - 2. Tank drain.
 - 3. Pre-charge to 60 psig.
 - 4. Provide seismic restraint in accordance with ASCE 7-10. Restraint must be tied back to structure.

C. Size:

1. 80 gallons (tank volume).
2. 80 gallons (max acceptance volume)
3. 24 Inches diameter.
4. 59 Inches overall length
5. 2-inch NPT system connection

D. Manufacturers:

1. AMTROL, Inc.
2. Flexcon Industries.
3. Wessels Company.

E. Amtrol WX-448, or approved equal.

2.3 TANK INSULATION

A. Tank Insulation: Provide 1" Insulation coat over entire diaphragm-type compression tank body.

1. Closed cell, fiber free elastomeric foam with microban antimicrobial product protection, formaldehyde-free and low VOCs.
2. Sheets and Rolls to be provided in with minimum width of 48".
3. Factory Mutual Approvals Criteria of:
 - A. Thermal Conductivity of 0.25 BTU-in/hr. Ft² °F
 - B. Water Vapor Transmission: 0.05 perm-inch
 - C. Fire Rating (ASTM E 84): Flame Spread Index less than 25 and Smoke-development less than 50.
4. Product: AP/Armaflex by Armacell Engineered Foams, or approved equal.

B. Insulation Adhesive: Insulation shall be manufacturer recommended adhesive suitable for adhering to steel tanks.

1. Product: Armaflex 520, or approved equal.

C. UV/Weather Paint Exterior Coating: Coating shall be manufacturer recommended protective coating to protect insulation from ultraviolet radiation, weather and ozone damage.

1. Product: Armaflex WB Finish, or approved equal.

PART 3 - EXECUTION**3.1 DIAPHRAGM-TYPE COMPRESSION TANKS**

A. Install unit in accordance with manufacturer's installation recommendations.

END OF SECTION

SECTION 40 90 00
PROCESS CONTROL AND INSTRUMENTATION SYSTEMS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall provide all Process Control and Instrumentation Systems (PCIS) scope, complete and operate, in accordance with the Contract Documents.
- B. The Contractor shall provide MCV-101 Control Panel. All instrumentation and controls external to the panel shall be installed, calibrated and commissioned by the Contractor.
- C. All instrumentation, controls, and wiring to and from the instruments and controls shall be installed, calibrated and commissioned by the Contractor.
- D. The requirements of this Section apply to all components of the PCIS, unless indicated otherwise.
- E. All items in this section shall comply with Section 26 00 00 - Electrical Work, General.
- F. All items in this section shall be NRTL listed for its use, or NRTL recognized if used as part of a listed assembly.
- G. All items whose process connections are to water, or chemicals mixed in water shall either be NSF listed or shall be made of material suitable for potable water.
- H. Responsibilities
 - 1. The Contractor, through the use of an Instrumentation Supplier, panel fabricator, and qualified electrical and mechanical installers, shall be responsible to the Owner for the implementation of the PCIS and the integration of the PCIS with other required instrumentation and control devices.
 - 2. Due to the complexities associated with the interfacing of numerous control system devices, it is the intent of these Specifications that the Instrumentation Supplier be responsible to the Contractor for the integration of the PCIS with devices provided under other sections, with the objective of providing a completely integrated control system free of signal incompatibilities.
 - 3. As a minimum, the Instrumentation Supplier shall perform the following Work:
 - a. Implementation of the PCIS
 - 1) prepare analog hardware submittals
 - 2) prepare the test plan, the training plan, and the spare parts submittals
 - 3) procure hardware
 - 4) oversee and certify hardware installation
 - 5) oversee, document, and certify loop testing
 - 6) prepare Technical Manuals
 - 7) prepare edited set of record drawings

4. Any Instrumentation Supplier responsibilities in addition to the list above are at the discretion of the Contractor and the Instrumentation Supplier. Additional requirements in this Section and throughout Division 40 which are stated to be the Contractor's responsibility may be performed by the Instrumentation Supplier if the Contractor and Instrumentation Supplier so agree.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 Submittal Procedures and the following:
 1. The Contractor shall coordinate the instrumentation work so that the complete instrumentation and control system will be provided and will be supported by accurate Shop Drawings and record drawings.
 2. Exchange of Technical Information: During the period of preparation of these submittals, the Contractor shall authorize a direct, informal liaison with the Engineer for exchange of technical information. As a result of this liaison, certain minor refinements and revisions in the systems as indicated may be authorized informally by the Engineer, but will not alter the scope of work or cause increase or decrease in the Contract Price. During this informal exchange, no oral statement by the Engineer shall be construed to give approval of any component or method, nor shall any statement be construed to grant exception to or variation from these Contract Documents.
 3. Symbolology and Nomenclature: In these Contract Documents, all systems, all meters, all instruments, and all other elements are represented schematically, and are designated by symbolology as derived from Instrument Society of America Standard ANSI/ISA S5.1 – Instrumentation Symbols and Identification. The nomenclature and numbers designated herein and on the Contract Drawings shall be employed exclusively throughout Shop Drawings, and similar materials. No other symbols, designations, or nomenclature unique to the manufacturer's standard methods shall replace those prescribed above, used herein, or on the Contract Drawings.
- B. Shop Drawings
 1. General
 - a. Shop Drawings shall include the letterhead or title block of the Instrumentation Supplier. The title block shall include, as a minimum, the Instrumentation Supplier's registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing. The quantity of submittal sets shall be as indicated in Section 01 33 00 Submittal Procedures.
 - b. Organization of the Shop Drawing submittals shall be compatible with eventual submittals for later inclusion in the Technical Manual.
 - c. Shop Drawing information shall be bound in standard size, three-ring, loose-leaf, vinyl plastic, hard cover binders suitable for bookshelf storage. One set of drawings for each facility is to be hung inside the control panel. The drawings are to be enclosed in PVC pockets suitable for hanging from a 3-ring binder, two drawings per pocket. The ring binder is to be attached to the inside of the front panel door.
 - d. Interfaces between instruments, motor starters, control valves, variable speed drives, flow meters, chemical feeders and other equipment related to the PCIS shall be included in the Shop Drawing submittal.

2. Analog Hardware Submittal: The Contractor shall submit an analog hardware submittal as a complete bound package at one time within 60 calendar days after the commencement date stated in the Notice to Proceed, including:
 - a. A complete index which lists each device by tag number, type, and manufacturer. A separate technical brochure or bulletin shall be included with each instrument data sheet (original documents only – photocopies are not acceptable and will be rejected). The data sheets shall be indexed in the submittal by systems or loops, as a separate group for each system or loop. If, within a single system or loop, a single instrument is employed more than once, one data sheet with one brochure or bulletin may cover all identical uses of that instrument in that system. Each brochure or bulletin shall include a list of tag numbers for which it applies. System groups shall be separated by labeled tags.
 - b. Fully executed data sheets according to ISA-S20 – Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves, for each component, together with a technical product brochure or bulletin. The technical product brochures shall be complete enough to verify conformance to all Contract Document requirements. The data sheets, as a minimum, shall show:
 - 1) Component functional description used in the Contract Documents
 - 2) Manufacturer's model number or other product designation
 - 3) Project tag number used in the Contract Documents
 - 4) Project system or loop of which the component is a part
 - 5) Project location or assembly at which the component is to be installed
 - 6) Input and output characteristics
 - 7) Scale, range, units, and multiplier (if any)
 - 8) Requirements for electric supply (if any)
 - 9) Requirements for air supply (if any)
 - 10) Materials of component parts to be in contact with or otherwise exposed to process media and corrosive ambient air
 - 11) Special requirements or features
 - c. Priced list of all spare parts for all devices.
 - d. Instrument installation, mounting, and anchoring details shall be submitted in an electronic hard copy format. Each instrument shall have a dedicated 8-1/2-inch by 11-inch detail which only pertains to the specific instrument by tag number. Each detail shall be certified by the instrument manufacturer that the proposed installation is in accordance with the instrument manufacturer's recommendations and is fully warrantable. These certifications shall be embedded in the CAD files and also appear as a stamp on the hard copies. As a minimum, each detail shall have the following contents:
 - 1) Show all necessary sections and elevation views required to define instrument location by referencing tank, building or equipment names and numbers, and geographical qualities such as north, south, east, west, basement, first floor.
 - 2) Process line pipe or tank size, service and material.

- 3) Process tap elevation and location.
 - 4) Upstream and downstream straight pipe lengths between instrument installation and pipe fittings and valves.
 - 5) Routing of tubing and identification of supports.
 - 6) Mounting brackets, stands, and anchoring devices.
 - 7) Conduit entry size, number, location, and delineation between power and signal.
 - 8) NEMA ratings of enclosures and all components.
 - 9) Clearances required for instrument servicing.
 - 10) List itemizing all manufacturer makes, model numbers, quantities, lengths required, and materials of each item required to support the implementation of the detail.
3. Test Procedure Submittals
 - a. The Contractor shall submit the proposed procedures to be followed during tests of the PCIS and its components.
 - b. Preliminary Submittal: Outlines of the specific proposed tests and examples of proposed forms and checklists.
 4. The Contractor shall provide a submittal of the CSPDF's certifications, and project history before submitting any Shop Drawings or commencing any work on the control panels.

C. Technical Manual

1. General: Information in the Technical Manual shall be based upon the approved Shop Drawing submittals as modified for conditions encountered in the field during the Work.
2. The Technical Manual shall have the following organization for each process:
 - a. Section C – Edited As-Built Drawings
 - b. Section D – Instrument Summary
 - c. Section E – Instrument Data Sheets
 - d. Section G – Instrument Installation Details
 - e. Section H – Test Results
3. Signed results from Loop Testing and FAT test, as applicable
4. Initially, two sets of draft Technical Manuals shall be submitted for review after return of favorably reviewed Shop Drawings and data required herein. Following the Engineer's review, one set will be returned to the Contractor with comments. The Manuals shall be revised and amended as required and the final Manuals shall be submitted 15 days prior to start-up of systems.

D. Record Drawings

1. The Contractor shall keep current a set of complete loop and schematic diagrams which shall include all field and panel wiring, piping and tubing runs, routing, mounting details, point to point diagrams with cable, wire, tube and termination numbers. These drawings

shall include all instruments and instrument elements. One set of drawings electronically formatted in AUTOCAD on a USB drive and two hard copies shall be submitted after completion of all commissioning tasks. All such drawings shall be submitted for review prior to acceptance of the completed work by the Owner.

1.3 WARRANTY

- A. The warranty shall start from the date of final acceptance of the completed project, and shall extend for 1 year, in accordance with Section 01 60 00 Product Requirements.

PART 2 - PRODUCTS

2.1 FLOW METER (ELECTROMAGNETIC)

- A. General
 - 1. Function: Measure, indicate, and transmit the process flow in a full pipe. Meter must be a full bore meter with the magnetic field traversing the entire cross-section of the flow tube. Insertion magmeters or multiple single point probes inserted into a spool piece are not acceptable.
 - 2. Type: Magnetic flowmeter, operating based on Faraday's law, using a pulsed DC type coil excitation with high impedance electrodes.
 - 3. Parts: Flow tube, transmitter, interconnection cables.
- B. Service: potable water, NSF listed
- C. Electrical: FM Listed.
- D. Performance
 - 1. Range: 1500 to 1.
 - 2. Accuracy: Accuracy shall be +/- 0.4% of rate for all flow rates greater than 22 gallons per minute
 - 3. Repeatability: +/- 0.05% or +/- 0.0008ft/s, whichever is greater.
 - 4. Calibration shall be per compliance with OIML R49 Type P recommendation.
 - 5. Flow range: As noted
- E. Process Connection
 - 1. Meter Size: As noted
 - 2. Connection Type: Flanged: ASME Class 150 up to 24 inch.
 - 3. Flange Material: Carbon steel
 - 4. Pressure Rating: Meter system shall be fully rated to the same design pressure as the flanges
- F. Flow Tube:
 - 1. Liner Material: Hard Rubber Standard.
 - 2. Electrode Type: Conical self-cleaning electrodes
 - 3. Electrode Material: 316 stainless steel standard
 - 4. Enclosure Classification: Standard as submersible and buriable (IP68, NEMA 6P)

5. Housing Material: Epoxy Coated Carbon Steel
6. Grounding: Grounding rings shall be provided
7. Submergence: Continuous to 30ft and direct burial 3 to 16 ft. (IP68, NEMA 6P)
8. Sensors in all sizes shall be provided with full bore design to reduce head loss.

G. Transmitter

1. Power: 85 to 265 VAC or 17 to 24 VDC
2. Display: Three line back-lit graphical display with capacitive keys; allows for external configuration without removing covers and compromising the integrity of environmental classifications.
3. Bi-directional flow: Forward and reverse flow indication; total and rate 2x10-digit user configurable display.
4. Totalizers: Three 9 digit totalizers for forward, reverse and net
5. Enclosure: Powder coated aluminum
6. "Through The Glass Control" with capacitive keys (no push button key pad)
7. 4-20mA and HART protocol standard with Profibus DP and Modbus as optional outputs
8. Integral Transmitter rotatable up to 270 degrees without tools
9. IP 67 Nema 4X
10. Calibration shall be per OIML R49 Type P standards
11. Type "P" continuous self-checking capabilities (not just on start-up)
12. Redundant data storage in sensor and transmitter with continuous replication of calibration factors, meter size, serial numbers, and site-specific settings.
13. Infrared service port for meter configuration and diagnostic interrogation. Shall have capability to connect to laptop. Shall be able to configure as keypad image, Hart or HyperTerminal. Shall be able to perform remote trouble shooting from remote location with computer laptop packages such as PC anywhere.
14. Cable: Meter loop shall only require one cable and conduit between primary sensor and transmitter. Cable and termination strips shall be color coded to allow for easy installation.

H. Calibration.

1. Test Mode: Provide the ability to verify the accuracy of the unit and the integrity of the current loop without any external equipment.
2. Meter calibration shall be compliant to OIML R49 Type P, self-calibration requirements.
3. Meter must be able to periodically generate simulated signals that verify that the output is within predefined limits.
4. Coil inductance and resistance along with electrode voltage and impedance must be verifiable through diagnostic functionality
5. Warnings and Alarms: Shall be classified to NAMUR NE 107 standards. Meter must have ability to display severity of warning with "maintenance, check-function, failure and out of spec" warning indications.
6. Alarm priorities shall be classified as: "None; Maintenance; Out-of-spec; Function check; and Error."
7. The quantity of occurrences, total time duration of the alarm occurrences, and time since last occurrence.
8. All replacement transmitters shall be interchangeable without need for programming sensor calibration factors, meter size, site information, and serial numbers

9. Insitu Calibration Verification: This system shall be used to verify in a quantifiable manner the meter's current conditions vs. the meters condition when originally manufactured. This calibration verification of the meter shall be performed without need for physical access to the meter flow tube. Method must be able to print out hard copy of verification and diagnostic reports.
 10. Meters to be designed, manufactured, and calibrated in an ISO9001, UKAS/NAMAS, NIST, or NATA certified facility. Flow facility must be certified by volume or weight certified provers. Facility must have the capability to hold the flow rate at the specified calibration points for a minimum of five minutes to allow stabilization for flow and repeatability point checks.
- I. Acceptable Manufacturers: ABB or pre-qualified equal.
 - J. Acceptable models:
 1. FIT-001 through -005:
 - a. FER121.050.K.1.S.1.A1.B.1.A.1.A.2.A.2.B.3.A.1-M5.V0.CWC.T3 or pre-qualified equal.
 2. FIT-101:
 - a. FEV121.050.K.1.S.1.A1.B.1.A.1.A.2.A.2.B.3.A.1-M5.V0.CWC.T3 or pre-qualified equal.

2.2 PRESSURE INDICATOR AND TRANSMITTER

- A. Refer to Instrument Index for Basis of Design manufacturer and model

2.3 PRESSURE SWITCH

- A. Refer to Instrument Index for Basis of Design manufacturer and model

2.4 DIFFERENTIAL PRESSURE SWITCH

- A. Refer to Instrument Index for Basis of Design manufacturer and model

2.5 FLOW SWITCH

- A. Refer to Instrument Index for Basis of Design manufacturer and model

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
 1. Instrumentation, including instrumentation furnished under other Divisions, shall be installed under Division 40 and the manufacturers' instructions.
 2. Equipment Locations: The monitoring and control system configurations indicated are diagrammatic. The locations of equipment are approximate. The exact locations and

routing of wiring and cables shall be governed by structural conditions and physical interferences and by the location of electrical terminations on equipment. Equipment shall be located and installed so that it will be readily accessible for operation and maintenance. Where job conditions require reasonable changes in approximated locations and arrangements, or when the Owner exercises the right to require changes in location of equipment which do not impact material quantities or cause material rework, the Contractor shall make such changes without additional cost to the Owner.

B. Conduit, Cables, and Field Wiring

1. Conduit shall be provided under Division 26.
2. Process equipment control wiring, 4-20 mA signal circuits, signal wiring to field instruments, Controller input and output wiring and other field wiring and cables shall be provided under Division 26.
3. Terminations and wire identification at PCIS equipment furnished under this or any other Division shall be provided under Division 40.

C. Instrumentation Tie-Downs: Instruments, control panels, and equipment shall be anchored by methods that comply with seismic requirements applicable to the Site.

D. Ancillary Devices: The Contract Documents show all necessary conduit and instruments required to make a complete instrumentation system. The Contractor shall be responsible for providing any additional or different type connections as required by the instruments and specific installation requirements. Such additions and such changes, including the proposed method of installation, shall be submitted to the Engineer for approval prior to commencing the Work. Such changes shall not be a basis of claims for extra work or delay.

E. Installation Criteria and Validation: Field-mounted components and assemblies shall be installed and connected according to the requirements below:

1. Installation personnel have been instructed on installation requirements of the Contract Documents.
2. Technical assistance is available to installation personnel at least by telephone.
3. Installation personnel have at least one copy of the approved Shop Drawings and data.
4. Flexible cables and capillary tubing shall be installed in flexible conduits. The lengths shall be sufficient to withdraw the element for periodic maintenance.
5. Power and signal wires shall be terminated with crimped type lugs.
6. Connectors shall be, as a minimum, watertight.
7. Wires shall be mounted clearly with an identification tag that is of a permanent and reusable nature.
8. Wire and cable shall be arranged in a neat manner and securely supported in cable groups and connected from terminal to terminal without splices, unless specifically approved by the Engineer. Wiring shall be protected from sharp edges and corners.
9. Fasteners using adhesives are not permitted.
10. Mounting stands and bracket materials and workmanship shall comply with requirements of the Contract Documents.

11. Verify the correctness of each installation, including polarity of electric power and signal connections, and make sure process connections are free of leaks. The Contractor shall certify in writing that discrepancies have been corrected for each loop or system checked out.
12. The Owner will not be responsible for any additional cost of rework attributable to actions of the Contractor or the Instrumentation Supplier.

3.2 CALIBRATION

- A. General: Devices provided under Division 40 shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.
- B. Calibration Points: Each instrument shall be calibrated at 20, 60, and 100 percent of span using test instruments to simulate inputs. The test instruments shall have accuracies traceable to National Institute of Testing Standards.
- C. Bench Calibration: Instruments that have been bench-calibrated shall be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, shall be made only after consultation with the Engineer.
- D. Field Calibration: Instruments that were not bench-calibrated shall be calibrated in the field to insure proper operation in accordance with the instrument loop diagrams or specification data sheets.
- E. Analyzer Calibration: Each analyzer system shall be calibrated and tested as a workable system after installation. Testing procedures shall be directed by the manufacturers' technical representatives. Samples and sample gases shall be furnished by the manufacturers.
- F. Calibration Sheets: Each instrument calibration sheet shall provide the following information and a space for sign-off on individual items and on the completed unit:
 1. Project name
 2. Loop number
 3. Tag number
 4. Manufacturer
 5. Model number
 6. Serial number
 7. Calibration range
 8. Calibration data: Input, output, and error at 20 percent, 60 percent and 100 percent of span
 9. Switch setting, contact action, and deadband for discrete elements
 10. Space for comments
 11. Space for sign-off by Instrumentation Supplier and date
 12. Test equipment used and associated serial numbers

- G. Calibration Tags: A calibration and testing tag shall be attached to each piece of equipment or system at a location determined by the Engineer. The Contractor shall have the Instrumentation Supplier sign the tag when calibration is complete. The Engineer will sign the tag when the calibration and testing has been accepted.

3.3 LOOP TESTING

- A. General: Individual instrument loop diagrams per ISA Standard S5.4 - Instrument Loop Diagrams, expanded format, shall be submitted to the Engineer for review prior to the loop tests. The Contractor shall notify the Engineer of scheduled tests a minimum of 30 days prior to the estimated completion date of installation and wiring of the PCIS. After the Engineer's review of the submitted loop diagrams for correctness and compliance with the Specifications, loop testing shall proceed. The loop check shall be witnessed by the Engineer.
- B. Instrument and Instrument Component Validation: Each instrument shall be field-tested, inspected, and adjusted to its indicated performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or, in the absence of a Contract requirement, any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer and at the Contractor's expense.
- C. Loop Validation: Controllers and electronic function modules shall be field-tested and exercised to demonstrate correct operation of the hardware and wiring. Control loops shall be checked under simulated operating conditions by impressing input signals at the primary control elements and observing appropriate responses at register in the PLC processor. Actual signals shall be used wherever available. Following any necessary corrections, the loops shall be retested.
- D. Loop Validation Sheets: The Contractor shall prepare loop confirmation sheets for each loop covering each active instrumentation and control device including simple hand switches and lights. Loop confirmation sheets shall form the basis for operational tests and documentation. Each loop confirmation sheet shall cite the following information and shall provide spaces for sign-off on individual items and on the complete loop by the Instrumentation Supplier:
 - 1. Project name
 - 2. Loop number
 - 3. Tag number, description, manufacturer and model number for each element
 - 4. Installation bulletin number
 - 5. Specification sheet number
 - 6. Adjustment check
 - 7. Space for comments
 - 8. Space for loop sign-off by Instrumentation Supplier and date
 - 9. Space for Engineer witness signature and date
- E. Loop Certifications: When installation tests have been successfully completed for all individual instruments and all separate analog control networks, a certified copy of each test form signed by the Engineer or the Engineer's representative as a witness, with test data

entered, shall be submitted to the Engineer together with a clear and unequivocal statement that the instrumentation has been successfully calibrated, inspected, and tested.

3.4 PERFORMANCE TEST

- A. The entire PCIS hardware, field instruments, power supplies, and wiring shall operate for 30 days without failure.
- B. The Contractor shall furnish support staff as required to satisfy the repair or replacement requirements.
- C. If any component, other than field instruments, fails during the performance test, it shall be repaired or replaced and the PCIS shall be restarted for another 30-day period.

3.5 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

- A. For the purpose of this Section, the following conditions, in addition to the requirements in Section 01 70 00, Execution Requirements shall be fulfilled before the Work is considered substantially complete:
 - 1. Submittals have been completed and approved.
 - 2. The PCIS has been installed, calibrated, and loop tested.
 - 3. Spare parts and expendable supplies and test equipment have been delivered to the Engineer.
 - 4. The performance test has been successfully completed.
 - 5. Punch-list items have been corrected.
 - 6. Record drawings in both hard copy and electronic format have been submitted.
 - 7. Revisions to the Technical Manuals that may have resulted from the field tests have been made and reviewed.
 - 8. Debris associated with installation of instrumentation has been removed.
 - 9. Probes, elements, sample lines, transmitters, tubing, and enclosures have been cleaned and are in like-new condition.

END OF SECTION

SECTION 40 95 13 CONTROL PANELS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. General: The Contractor shall provide control panels, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 90 00 – Process Control and Instrumentation Systems apply to this Section.
 - 1. See 40 90 00 for the specific panels to be furnished by others.
- C. The provisions of this Section apply to local panels provided in equipment systems specified in other sections, unless indicated otherwise in those sections.
- D. Control panels shall be built to UL 508, or an independent testing laboratory acceptable to the local code enforcement agency having jurisdiction. The panels shall have UL labels attached to them by the panel builder. The panel builder shall provide with each panel a certification from the independent testing lab inspector that the panel is built to their standards.
- E. Panels equipped with Intrinsically Safe controls shall also bear UL 913 label in addition to the UL 508.

1.2 REFERENCE DOCUMENTS

- A. UL 508A – Standard for Industrial Control Panels
- B. NFPA 79 – Electrical Standard for Industrial Machinery
- C. NFPA 70 – Article 409

1.3 SUBMITTALS

- A. General: Submittals shall be furnished in accordance with Division 1.
- B. Control Panel Engineering Submittal: The Contractor shall submit a control panel engineering submittal (CPES) for each control panel and enclosure provided under Division 40. The CPES shall completely define and document the construction, finish, fuses, circuit breakers, internally-mounted hardware, communications hardware, and Control system components. All panel drawings shall, as a minimum, be "B" size with all data sheets and manufacturer specification sheets being "A" size. The submittal shall be in conformance with ISA-S20 – Standard Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves, shall be submitted as a singular complete bound volume or multi volume package within 60 calendar days after Notice to Proceed, and shall have the following contents:
 - 1. A complete index shall appear in the front of each bound volume. All drawings and data sheets associated with a panel shall be grouped together with the panels being indexed by systems or process areas. All panel tagging and nameplate nomenclature shall be consistent with the requirements of the Contract Documents.

2. Scale construction drawings which define and quantify the type and gauge of steel to be used for panel fabrication, the ASTM grade to be used for structural shapes and straps, panel door locks and hinge mechanisms, type of bolts and bolt locations for section joining and anchoring, details and proposed locations for "UNISTRUT" members, stiffener materials and locations, electrical terminal box and outlet locations, electrical access locations, print pocket locations, writing board locations, and lifting lug material and locations.
3. Cutout locations with nameplate identifications shall be shown.
4. The Contract Drawing wiring diagrams shall be edited to identify electrical devices, terminals, and interconnecting wiring. These diagrams shall show interconnecting wiring by lines, designate terminal assignments, and show the physical location of all electrical and control devices.
5. Completed ISA S20 data sheets for all instrumentation devices associated with each control panel supplemented with manufacturer specification sheets which verify conformance to the requirements of the Contract Documents.
6. A bill of material which enumerates all devices associated with the control panel.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Environmental Suitability: All indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided as shown on the Drawings in order to maintain all instrumentation devices 20 percent within the minimums and maximums of their rated environmental operating ranges. The Contractor shall provide all power wiring for these devices. Enclosures suitable for the environment shall be provided. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.
- B. Panel construction shall conform to NFPA 70 (NEC) Article 409 and NFPA 79.
- C. Control Panel controls shall be 24 VDC. Control conductors shall be provided in accordance with the indicated requirements.
- D. The control panel shall be the source of power for any 120 VAC controls or equipment interconnected with the control panel. All equipment associated with the control panel shall be ready for service after connection of conductors to equipment, controls, and control panel.
- E. Devices and instruments powered from the Control Panel shall have their circuits individually protected such that the failure of one will not affect any other.
- F. Unless indicated otherwise, control panels shall be housed in NEMA-rated enclosures as shown on the Drawings. Control panels shall be either wall-mounted, pedestal-mounted or equipment skid-mounted, as indicated. Internal control components shall be mounted on an internal back-panel or side-panel as required.
 1. All interior control or relay panels mounted above ground level shall be NEMA 12.

2. All exterior control panels and enclosures mounted above ground level, unless noted otherwise on the Drawings, shall be NEMA 4X.
 3. All control panels mounted in enclosures meeting the above requirements shall be NEMA 1.
- G. Each source of 'external' voltage shall be isolated by providing disconnecting fused terminal blocks, circuit breakers or DIN rail mounted relays. Each control panel shall be provided with identified terminal strips for the connection of all external conductors. The Contractor shall provide sufficient terminal blocks as shown on the Drawings.
- H. Motor starters, where required, shall be in accordance with Division 26. Each motor starter shall be provided with Controller interface circuits as indicated on the drawings. Electrical components shall be of standard American manufacture.
- I. Discrete outputs from the control panels shall be provided by electrically isolated contacts rated for 2 amps at 24 VDC or 5 amps at 120 VAC.
- J. All control panel mounted devices shall be provided as shown on the Drawings.
- K. Painting: Steel control panels shall be thoroughly cleaned and sand blasted per Steel Structures Painting Council Specification SSPC SP 6 (Commercial Blast) after which surfaces shall receive a prime coat of Amercoat 185, or equal, 3 mils DFT, for a total thickness of the prime plus finish system of 6 mils. The finished color of the outside surfaces shall be ANSI 61 gray paint. Interior of the control panel, back-panel, and side-panels shall have a white finish coat.

2.2 CONTROL PANELS

- A. Exterior control enclosures shall be deadfront, lockable, hinged-door units mounted as shown on the plans.
- B. NEMA 1 control panel within a suitably rated enclosure shall be
1. Steel panel section faces shall be No. 14 gauge minimum thickness, unless otherwise indicated on the Drawings. All materials shall be selected for levelness and smoothness.
 2. Structural shapes and strap steel shall comply with ASTM A 283 – Low and Intermediate Tensile Strength Carbon Steel Plates, Grade C.
 - a. Bolting Material: Commercial quality carbon steel bolts, nuts, and washers shall be 1/2-inch diameter with UNC threads. Carriage bolts shall be used for attaching end plates. All other bolts shall be hex end machine bolts. Nuts shall be hot pressed hex, American Standard, heavy. Standard wrought washers shall be used for foundation bolts and attachments to building structures. All other bolted joints shall have SAE standard lock washers.
 3. Construction: Dimensions shall be as required but no larger than the unit shown on the Drawings.
 4. Enclosures and Panels shall be as manufactured by Hoffman, or equal.
- C. Fabrication

1. End plates, top plates, and top closure panels (to hung ceiling) shall be provided when required by the material requisition. End plates, top plates, and top closure panels shall be removable with countersunk bolts to match panels. Top closure panels shall be furnished in lengths that match the widths of standard panels, except that one top closure panel may extend across two 4 feet 6 inches wide or five 2 feet wide standard panels. The vertical joints of these panels shall align with the vertical joints of the standard panels.
2. Doors shall be flush-fitting, gasketed, and be of the hinged type with door handles. Screwdriver 1/4 turn or Dzus type fasteners are not acceptable.
 - a. The flanged edges of all panels shall be straight and smooth. Corners shall be welded and ground smooth.
 - b. The face of the panel shall be true and level after flanging.
 - c. All panel cut outs and holes may be cut or drilled by any standard method that does not cause deformation. Burrs shall be ground smooth.
 - d. Adjacent panels shall assemble with faces flush. Gaps or cracks shall not be visible from the front of the assembled instrument board.
 - e. Stiffeners shall be welded to the back of panels, as required to prevent panel deformation due to the weight of face-mounted instruments.
 - f. Panels shall be self-supporting as defined below.

D. Preparation of Panel Surface

1. The following requirements apply to the front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all holes or cut outs.
 - a. All high spots, burrs, and rough spots shall be ground smooth.
 - b. The surfaces shall be sanded or sandblasted to a smooth, clean, bright finish.
 - c. All traces of oil shall be removed with a solvent.
 - d. The first coat of primer shall be applied immediately.

E. Instrument Finishing: The final coats applied to painted surface of instrument cases, doors, or bezels that are visible from the front of panels shall be manufacturer's standard, unless otherwise indicated. Black japan or "crinkle" finishes on instrument cases are not acceptable.

F. Mounting of Instruments

1. The panel vendor shall provide cut outs, and shall mount all instrument items indicated to be panel-mounted, including any instruments indicated to be furnished by other vendors but installed in the panel.
2. The panel vendor shall also mount behind the panels other instrument accessory items as required for functionality or as indicated.
3. Equipment mounted at the rear of panel shall be installed to allow for commissioning adjustments, servicing requirements, and cover removal.
4. Spare space shall be kept clear of wiring, etc., to give maximum space for future additions.

G. Electrical Requirements

1. The Contractor shall provide conduit, wireways, switches, wire, and electrical fittings for all 24 VDC and 120 VAC circuits to instruments and other electrical devices as required for a complete and operable installation.
2. Conduit, wireways, junction boxes and fittings shall include those required between sensors and transmitters and between the junction boxes and instruments.
3. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. Wiring shall be identified with stamped tubular wire end markers. Terminals shall be DIN rail mounted, rated at 400 VAC, manufactured by Entrelec, or equal.
4. Wiring Methods: Wiring methods and materials for all panels shall be in accordance with the N.E.C. requirements for General Purpose (no open wiring) unless otherwise indicated.
5. Signal and Control Circuit Wiring
 - a. Wire type and sizes: Conductor shall be flexible stranded copper wire, UL. Wires for instrument signal circuits and alarm input circuits shall be No. 16 AWG Type MTW rated for 300 volts. The analog cables between the PLC I/O card and terminal strips shall be (8) conductor No. 18 AWG cable rated 300 volts for loop powered devices and 8-pair shielded No. 18 AWG cable rated 300 volts for 4-wire loops. DeviceNet cable shall be as per Allen-Bradley requirements, and terminated per Allen-Bradley requirements.
 - b. Wire Insulation Colors:
 - 1) 120 VAC Power - Black 14 AWG minimum
 - 2) 120 VAC Neutral - White 14 AWG minimum
 - 3) 120 VAC Ground - Green 14 AWG minimum
 - 4) 120 VAC Control - Red 14 AWG minimum
 - 5) 120 VAC Foreign Power - Yellow 16 AWG minimum
 - 6) 120 VAC Foreign Neutral - Yellow 16 AWG minimum
 - 7) DC Positive - Blue 16 AWG minimum
 - 8) DC Negative - White/Blue 16 AWG minimumAll 120 VAC power wiring protected by the main circuit breaker and incoming power service shall be No. 12 AWG.
 - c. Wire Marking: Wire numbers shall be marked using white numbered wire markers made from heat shrink plastic. Wire designations shall be marked per manufacturers method. Numbers shall read from left to right.
 - d. Terminals shall be labeled and a Wire List provided with the As-Built plans depicting terminal device and/or termination assignments
 - e. Flexible conduit is only to be used where specified.
 - f. Conduit fittings shall be Crouse Hinds cast fittings, or equal.
 - g. For equipment grounding, panels shall be provided with a 1/4 inch by 1 inch copper ground bus complete with solder-less connector for one No. 4 AWG bare stranded

copper cable. The copper cable shall be provided by the Contractor and be connected to the electrical equipment ground of the 120-volt panel supplying power.

6. Power Supply Wiring

- a. Unless otherwise indicated, all instruments, alarm systems, and motor controls shall operate on 120 VAC circuits.
- b. The panel fabricator shall provide terminal box connections for the main power supply entry as shown on the Drawings.
- c. When instruments do not come equipped with integral fuses, provide fuses as required for the protection of individual instruments against fault currents. Fuses shall be mounted on the back of the panel in a fuse holder, and each fuse shall be identified by a service name tag. Fuses shall be as manufactured by Bussmann Manufacturing Division, Type KAW TRON, or equal. Circuit breakers shall be provided as shown on the Drawings.

H. Relays:

1. DIN rail mounted relays shall have contacts rated at 8 amps, 230 volts, at 20,000 operations. The coils shall be 120 VAC. Relays shall be IDEC model RJ2S-CL-A120, double pole double throw, or approved equal.

I. UPS

1. Provide SOLA Hevi-Duty SDU500 or approved equal.

- J. Terminals: Fused Terminals for analog input and output points shall be a 3-wire terminal with a fused circuit, a feed through circuit and a ground terminal. Fused Terminals for the discrete input points shall be 2-wire terminal with a fused circuit and a feed through circuit. Provide a one-tenth of an ampere rapid blow 250-volt fuse for all analog circuits and all discrete input circuits. The analog terminals shall be Weidmuller model KDKS 1 part 953245, and the discrete input terminal shall be Weidmuller model KDKS 1 PE part 953245.

K. Spare Fuses: For each panel, provide the following spare fuses:

1. A minimum of two spare fuses of each size
2. One spare fuse for every ten fused circuits

Provide the fuses in a spare fuse box mounted on the interior wall of the panel. Fuse box shall be Plano Tackle Systems 1061 Accessory Box, Plano, IL, www.planomolding.com, or equal.

- L. 120 VAC Surge Arrestor: A 120 VAC three-stage surge protector shall be provided on the main leads of each panel. The surge protector shall include a first stage inline inductor, a second stage MOV to ground with a thermal fuse, and a third stage array of MOVs to provide a small amount of capacitance. The unit shall be DIN rail-mounted. The MOV shall include green LED to indicate the status of the second stage MOV. Provide two (2) spare units for each panel. The unit shall be rated for 120 VAC and shall be either Advance Surge Suppressor model TSP-WG6-120VAC-10A-01, Control Concepts 'Islatrol Elite' model IE-110, or equal.

M. Miscellaneous Parts:

1. Each panel shall be provided with a large steel folding shelf, 12 inches deep by 18 inches wide, Hoffman model A-ASHLF1218, or equal, installed on the panel door as shown on the Drawings..
 2. Each panel shall be provided with a data pocket holder 1 inch deep by 12 inches wide by 12 inches high, Hoffman model A-DP2, or equal, installed on the panel door as shown on the Drawings.
- N. Labor and Workmanship: Panels shall be fabricated, piped, and wired by fully qualified workmen who are properly trained, experienced, and supervised.

2.3 MARKING

- A. Control panels shall be marked with the following information that is plainly visible after installation:
1. Manufacturer's name
 2. Supply voltage
 3. Short-circuit rating of the main breaker
 4. Name of the project and site
 5. Enclosure rating

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Preparation for Shipment and Shipping
1. Panels shall be crated for shipment using a heavy framework and skids. Panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. Instruments that are shipped with the panel shall further have suitable shipping stops and cushioning material installed to protect parts that could be damaged due to mechanical shock. Each separate panel unit shall be provided with removable lifting lugs to facilitate handling.
 2. All control panel factory testing and inspection shall be performed prior to shipping.
 3. Control panels shall be installed in accordance with Section 40 90 00 – Process Control and Instrumentation Systems.

3.2 PENETRATIONS

- A. All penetrations in NEMA 4X areas shall be bottom entry unless specifically indicated on the plans or by special, written, permission from the Owner or his representative.

3.3 CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

- A. Wiring Installation: All wires shall be run in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, (3) wiring from components on a swing out panel to components on a part of the fixed structure, and (4) wiring to panel mounted components. Wiring run from components on a swing out panel to other components on a fixed panel shall be made up in tied bundles. These bundles shall be tied with nylon wire ties

and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.

- B. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon wire ties and be secured to the inside face of the panel using adhesive mounts.
- C. Enclosures Wiring: All wiring shall be run in liquidtight flexible conduit (LFMC), unless otherwise noted on the Drawings. All enclosure wiring and raceways shall be installed by the panel builder in the shop.
- D. Wiring to rear terminals on panel mount instruments shall be in plastic wireways secured to horizontal brackets above or below the instruments in about the same plane as the rear of the instruments.
- E. Shop Drawings shall show conformance to the above wiring installation requirements.
- F. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number as shown on the Contract Drawings. These numbers shall be marked on all conductors at every terminal.

3.4 CALIBRATION, TESTING, AND INSTRUCTION

- A. General: Calibration, testing, and instruction shall be performed in accordance with Section 40 90 00 – Process Control and Instrumentation Systems.
- B. Inspection and Approval
 - 1. Panel fabricator shall conduct the following tests prior to arrival of the Engineer or before shipment, if the Engineer chooses not to witness factory testing.
 - a. All status, control, analog and alarm circuits rung out to determine their operability.
 - b. All electrical power circuits checked for continuity and where applicable, operability.
 - c. Any other test required to place the panel in an operating condition.
 - 2. Commissioning shall be performed per 26 08 00 Commissioning of Electrical and Control Systems.
 - 3. It shall be the responsibility of the Contractor to furnish all necessary testing devices and sufficient manpower to perform the tests required by the Engineer.
 - 4. Field Testing: Each control panel shall be tested again for functional operation in the field after the connection of external conductors and prior to equipment startup.

END OF SECTION

**DIVISION 43 PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE
EQUIPMENT**

SECTION 43 11 11 - DIRECT DRIVE SINGLE STAGE CENTRIFUGAL BLOWERS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: Direct-drive single-stage centrifugal blowers.
- B. Related Requirements:
 - 1. Section 260000 – Electrical Work, General
 - 2. Section 262923 - Variable-Frequency Motor Controllers: Execution and product requirements for equipment specified by this Section.
- C. All motors and other electrical equipment shall be NRTL listed for their intended use.

1.2 REFERENCE STANDARDS

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- C. ASME International:
 - 1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - 2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
- D. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information, including installation instructions, accessories, performance curves with specified operating point plotted, capacities and pressure differentials, power, rpm, sound power levels for both inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

C. Shop Drawings:

1. Furnish diagrams showing complete layout of system, including equipment, piping, valves, wiring and ladder diagrams, controls, and control sequences.
2. Indicate size and configuration of assembly, mountings, weights, and accessory connections.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

F. Provide Operation and Maintenance Manuals.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of blowers.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.7 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

- B. Unless a longer warranty is specifically specified, all components supplied by the pump manufacturer shall have a minimum 1-year warranty against defects and a limited 5-year warranty from the date of project substantial completion.

PART 2 - PRODUCTS

2.1 SINGLE-STAGE CENTRIFUGAL BLOWERS

A. Description:

1. Furnish air-moving equipment complete with drive units, filters, controls, and appurtenances.
2. Furnish each unit with vibration isolation and thermal overloads, HIGH PRESSURE and LOW PRESSURE safety cutoffs, LOW OIL PRESSURE cutout, internal pressure relief valve, and protection against short cycling.
3. Blower shall be designed for continuous operating service and constructed as follows to meet the intended service.
4. Blower shall be warranted for a period of two full years after date of installation.
5. Blower shall be provided complete, factory assembled, including electric motor drive.

B. Performance and Design Criteria:

1. Base Condition: Sea Level.
2. Duty Point: 113 scfm at 6 psi.

C. Inlet and Discharge Connections:

1. 2.5 Inches: Threaded.

D. Blower:

1. Type: Bi-lobe positive displacement.
2. Lubrication: Food grade.
3. Accessories
 - a. V-belts, sheaves, guard, BBF-200 inlet filter silencer.
 - b. Provided by the blower manufacturer.

E. Operation:

1. Electrical Characteristics:
 - a. As specified in Section 262923 - Variable-Frequency Motor Controllers.
 - b. 7.5 hp.
 - c. Voltage: 208 V, three phase, 60 Hz.
2. Motors:
 - a. Shall be NEMA standard design TC frame.

F. Manufacturer and Product:

1. Sutorbilt Legend – 3HS-RHC

2. Approved Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Standards: Install Work according to manufacturer's instructions and as shown on the Plans.
- B. Blower shall be set level and plumb with no stresses on the suction and discharge flanges.
- C. All strain from attached piping shall be eliminated from the blower, and any evidence of blower misalignment, noisy operation, or other signs of improper setting shall be corrected by the Contractor at no additional cost to the Owner.

3.2 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspection:
 1. Ensure that blowers and appurtenances have been installed correctly and that there is no objectionable heat or vibration.
 2. Ensure that bearings are adequately lubricated.
- C. Equipment Acceptance:
 1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
 2. Make final adjustments to equipment under direction of manufacturer's representative.

3.3 ADJUSTING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Adjust and balance blowers to accommodate load requirements.
- C. Check control functions and adjust as required.

END OF SECTION

SECTION 43 44 14
CHEMICAL FEED EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers chemical feed pumps and accessories, including: valves, chemical mixing and solution tanks, mechanical mixers, and in-line static mixers.
- B. All electrical equipment shall comply with section 26 00 00 – Electrical Work, General
- C. All electrical equipment shall be NRTL listed for their intended use.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Make, model, and weight of each equipment assembly.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Performance data on pumps, including curves showing flow rate and head at specified maximum speed.
 - 4. Pump data sheet confirming pump capacity in gallons per hour and pressure in psig, pipe connection sizes, materials, testing requirements, and appurtenances to be provided with pump.
 - 5. Detailed dimensional drawing.
 - 6. Power and control wiring diagrams, including terminals and numbers.
 - 7. Operational and Maintenance Data.
 - 8. Submit manufacturer's recommended spare parts list.
 - 9. Contractor shall submit field installation instructions illustrating the installation procedures and start-up instructions.
 - 10. Submit parts diagrams and lists, troubleshooting guide, and control wiring diagrams of the equipment.
- B. Test Reports:
 - 1. Submit certified factory test results.
 - 2. Submit certified field performance test results.
- C. Manufacturer's Installation Instructions:
 - 1. Submit detailed instructions on installation requirements including storage and handling procedures, anchoring, and layout.
 - 2. Submit application, selection, and hookup configuration with pipe and accessory elevations.

- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Submit certification after installation certifying equipment has been installed in accordance with manufacturer's instructions.
- F. Electrical and Controls: Provide submittals as required in Division 26, and as follows:
 - 1. Equipment power requirements
 - 2. Outline description of equipment operation and control
 - 3. Control logic schematics and wiring diagrams

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations and final orientation of equipment and accessories.
- B. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.
 - 1. Contractor shall submit four copies of the each pump's operation and maintenance (O&M) instructions.
 - 2. Such information shall include all pertinent drawings, vendor literature, installation instructions, and operation and maintenance instructions.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alaska standard.
- B. Ensure materials of construction on pump liquid end are compatible with chemicals being pumped.
- C. It is the intent of these specifications that the chemical feed system and related equipment shall be furnished as part of a coordinated system provided by a single supplier so that undivided responsibility for a complete and operable system is assured.
- D. The metering pump supplier shall be the Coordinating Supplier and be responsible for the following chemical feed system components:
 - 1. Metering pumps, spares and accessories
 - 2. Chemical feed tubing, valves and fittings
 - 3. Chemical injectors and check valves
 - 4. Chemical mixing tanks, batching tank, and accessories, including suction lance with level switches.
 - 5. Mechanical mixers
- E. Equipment specified in this section but not included above may be provided separately.

- F. Prior to submitting a bid, the coordinating supplier shall verify compatibility and adequacy of specified pump performance capabilities, feed line and accessory sizes, and system materials against the project conditions reflected in the Contract Documents.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum ten years documented experience.
- B. Coordinating Supplier of chemical feed system shall have at least 5 years of demonstrable experience in providing, starting, repairing and servicing similar chemical feed systems

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Packing, Shipping, Handling, and Unloading:
 - 1. Prepare the items for export shipping.
 - 2. Protect pumps and components from the weather, and physical damage including effects of being exposed to freezing temperatures for extended periods.
- C. Inspect for damage.
- D. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.7 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
- B. Except where a longer duration is otherwise specified, equipment and materials supplied under this section shall be warranted for a period of 2 years, by the chemical feed system Coordinating Supplier and the Contractor to be free from defects in workmanship and design.
- C. Furnish five year manufacturer's warranty for pumps.
- D. Any product or materials that fails or otherwise becomes defective during the warranty period shall be replaced and units restored to service at no expense to the Owner.
- E. Warranty periods shall commence on Substantial completion, as specified in the Contract.

1.8 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for spare parts and maintenance products.
- B. Furnish one complete set of manufacturer's recommended spare parts for each pump including but not limited to:

1. One complete rebuild kit for each feed pump provided, to include replacement diaphragm, ball check valves, O-rings, and gaskets.
- C. Furnish special tools required for equipment maintenance. Furnish list of equipment and tools needed to maintain and calibrate equipment.

PART 2 - PRODUCTS

2.1 CHEMICAL FEED PUMPS

A. Manufacturers:

1. Grundfos.
2. Substitutions: Section 01 60 00 - Product Requirements.
 - a. Note that substitutions will require contractor proposed revisions to the chemical dosing pump wiring as shown on the contract drawings. All wiring revisions and redlines required to support the proposed substitution are Contractors responsibility.

B. General:

1. Furnish and install listed or labeled positive displacement chemical feed pumps with autoprime, suitable for pumping dilute solutions of the chemicals for each feed point as described in the Chemical Equipment Schedules on the Drawings.
2. Materials:
 - a. Housing: chemically resistant plastic.
 - b. Process Diaphragm: As designated on Chemical Pump Schedule.
 - c. Head and Valves: As designated on Chemical Pump Schedule.
 - d. Gasket: As designated on Chemical Pump Schedule.

C. Pump Control:

1. Operating pump speed shall vary in direct proportion to plant raw water flow according to 4 to 20 mA signals transmitted by a dedicated flow meter as described in the Operational Narrative in the Drawings.
2. Output volume shall be manually-adjustable while pumps are in operation, from zero to the maximum capacity specified in this section.
3. Manual adjustment shall be by means of readily accessible dial knob(s).
4. Pump shall have inputs for integrated level switch for dosing tank low and empty alarms.
5. Pumps shall be powered as specified in Division 26.

D. Pump Drives:

1. The pump drive shall be totally enclosed with no exposed moving parts. Electronics shall be housed in chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage.

E. Pump Accessories:

1. Pumps shall be provided with automatic pressure relief valve or pump shall be designed to automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35%.
2. Anti-Siphon device: All new pumps shall be provided with a valve that will prevent chemicals from siphoning out of chemical mixing tanks.
3. Chemical metering pump valves shall be ball type, with ceramic balls PTFE. Valve seat and seal ring shall be renewable by replacing the combination seat-seal ring PTFE or cartridge valve assembly.
4. Tubing: A total of 30 ft of polyethylene tubing shall be provided per pump complete with compression connections.
5. PVC Ball valves: as specified in Section 40 05 50 – Process Valves.

2.2 PRIMER / FLUSH KITS

- A. As provided by Grundfos, or approved equal.

2.3 MECHANICAL MIXERS

- A. Mechanical mixers shall be provided for the chemical feed systems as designated in the Miscellaneous Equipment Schedule on the Drawings.
- B. Electrically driven mixing device, suitable for mounting on an angled platform. Shall operate on 120 VAC, 60 Hz.
- C. Materials: Per Chemical Equipment Schedules and Standard Details.
- D. Operation:
 1. Mechanical mixers operation shall be manual by the operator when batching chemicals.
- E. Mechanical mixers shall be provided with a suitable tank-independent support and power cord.
- F. Tag Numbers: As shown on Equipment Schedule on Drawings.

2.4 CHEMICAL MIXING VATS

- A. General:
 1. Provide chemical mixing tanks as specified on the Chemical Equipment Schedules and Standard Details.
 2. Mixing tanks shall be graduated and translucent, as manufactured by JL Wingert or approval equal.
 3. Tank material shall be compatible with stored chemical solution.
 4. Tanks shall be provided with capability to support lid as detailed on the Chemical Equipment Schedules.

2.5 IN-LINE STATIC MIXERS

- A. General:
 - 1. Mixers shall be of in-line motionless type and shall provide complete, homogeneous mixing of chemicals into the raw water stream at process flow rates ranging from 5 to 25 gpm.
 - 2. Maximum flange-to-flange pressure drop shall be less than 1 psi.
- B. Mixer configuration and materials shall be compatible with injected chemicals.
- C. Mixers shall consist of six mixing element sets, which, in combination, sweep approximately two-thirds of the pipe circumference, providing wall-to-wall radial mixing and fluid transfer.
- D. Mixer housings shall be constructed of clear Schedule 80 PVC, with flanged or threaded ends. Mixing elements shall be constructed of PVC or FRP.
- E. Mixer diameter shall match diameter of connecting process line pipe. Overall length shall be no greater than 12 inches.
- F. Mixers shall be manufactured by Koflo Corporation, Cary, IL, or approved equal.

2.6 INJECTORS

- A. Injectors shall be constructed of materials and installed as shown on the Drawings.

2.7 ISOLATION VALVES

- A. Provide isolation valves upstream and downstream of the mixer.
- B. Isolation valves shall be vented PVC ball valves, in accordance with Section 40 05 23 – Process Valves, or as approved.

2.8 SPARE PARTS

- A. Chemical Feed Pump and Accessories: Provide “O” rings, extra gaskets, check valve balls, anti-siphon valve, diaphragm, injection point check valve, pressure relief valve, and corporation stop and injection assembly, for each type of pump.
- B. Mechanical Mixer: Furnish one spare shaft and propeller for each different type of mixer.
- C. Additional components shall be provided as recommended by the manufacturers and Coordinating Supplier.
- D. All parts shall be handled in a manner to insure delivery in an undamaged condition, in the original protective packaging and tagged with part number, description, and part name.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install chemical feed system equipment in accordance with the manufacturer's instructions and the requirements of the Contract Documents.
- B. Install piping accessories in pump suction and discharge as indicated on Drawings.
- C. Connect piping to pump suction and discharge. Tubing and appurtenance installations shall be in accordance with Division 22, and as shown.
- D. Install power and control and wiring in accordance with Division 26.
- E. Flush piping with clean water.

3.2 FIELD QUALITY CONTROL

- A. Pre-operational Check: Before operating system or components, make the following checks:
 - 1. Remove all pipe shavings and other deleterious materials from tanks, pipes, and mixers.
 - 2. Vent air from system to assure water in pump.
- B. Start-up and Performance Testing:
 - 1. Contractor shall have all mechanical and electrical connections tested prior to connecting to the plant piping system.
 - 2. Determine calibration curves for each pumping unit by plotting capacity versus six different stroke settings between 0 and 100 percent at 10 percent increments.
 - 3. Operate each chemical feed system on clear water for continuous period of four hours, under supervision of manufacturer's representative. Demonstrate system control functions and alarms. Utilizing signal generator, demonstrate proper operation of pump pacing.
 - 4. Hydrostatically test system piping for leaks at 150 psig.
- C. Equipment Acceptance:
 - 1. Adjust, repair, modify and replace components of system failing to perform and repeat tests.
 - 2. Make final adjustments to equipment under direction of manufacturer's representative.

END OF SECTION

SECTION 43 61 13**FILTER MEDIA****PART 1 GENERAL****1.1 SUMMARY**

- A. Section includes
 - 1. This section includes the requirements for gravel, garnet, silica, greensand and anthracite used in, vertical, granular-bed, pressure filter vessels designed for use in municipal water treatment of both ground and surface waters.
- B. Related Sections:
 - 1. Section 01 33 00: - Submittals Procedures.
 - 2. Section 43 08 00: Commissioning of Process Systems.

1.2 REFERENCES

- A. Referenced Standards: To the extent referenced in this specification section, the standards and documents listed below are included, and made a part of this Specification. In the event of a conflict, the requirements of this Specification section prevail. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.
 - 1. American Water Works Association (AWWA):
 - a. AWWA B100: Granular Filter Media.
 - 2. National Sanitation Foundation (NSF):
 - a. NSF/ANSI Standard 61: Drinking Water System Components – Health Effects.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 - 1. Provide product data for each filter media type including:
 - a. Material properties.
 - b. Sieve analysis.
 - c. Manufacturer verification of compliance with AWWA B100 and NSF Standard 61.
 - d. A copy of the NSF 61 listing report.

1.4 QUALITY ASSURANCE**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Media shall be provided in separate shipping packages according to type and size ranges.
- B. Unless otherwise noted. All media shall be provided in 50 pound bags.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of this Section and Contract Documents acceptable manufacturers include the following
1. Red Flint Sand & Gravel, LLC.
 2. Or approved equal substitutions per Section 01 60 00 - Product Requirements.

2.2 MEDIA VOLUMES

- A. Media shall be provided in sufficient quantities to obtain the effective bed depths plus 10 percent (10%) extra for gravel and 20 percent (20%) extra for filter sand and anthracite.
- B. Gravel layer thickness to be determined by the location of the under drain assembly. The gravel layer shall reach the top of the under drain laterals, creating a flat surface for the placement of the sand layer.

6-ft Diameter Filter Media Depths and Volumes		
Filter Media	Layer Thickness (in)	Filter Media Volume per Filter Vessel (cf)
Gravel	18	63
Garnet	2	6
Greensand Plus	18	51
Anthracite	14	40

2.3 FILTER GRAVEL

- A. Media shall meet or exceed the requirements of AWWA B100 and NSF Standard 61, including but not limited to the following material properties:

Parameter	Value	Unit
Effective Size	3/8" x 3/16"	inch
Specific Gravity	2.5 - 2.7	-
Acid Solubility	<5	percent
Bulk Density	~100	lb/cu ft
Hardness	>7	Mohs Scale

2.4 GARNET

- A. Garnet shall consist of high hardness, high density granular particles. It shall be visibly free of shale, clay, and other extraneous material.
- B. Media shall meet or exceed the requirements of AWWA B100 and NSF Standard 61, including but not limited to the following material properties:

Parameter	Value	Unit
Nominal Sieve Size	#12	
Effective Size	1.5 – 1.7	mm
Uniformity Coefficient	1.21	-
Specific Gravity	3.8 – 4.2	-
Acid Solubility	<5	percent
Bulk Density	~145	lb/cu ft
Hardness	>7	Mohs Scale

2.5 GREENSAND PLUS

- A. Media shall meet or exceed the requirements of AWWA B100 and NSF Standard 61, including but not limited to the following material properties:

Parameter	Value	Unit
Effective Size	0.30– 0.40	mm
Uniformity Coefficient	< 1.6	-
Specific Gravity	2.3 – 2.5	-
Acid Solubility	<5	percent
Bulk Density	~85	lb/cu ft
Hardness	>3	Mohs Scale

2.6 ANTHRACITE

- A. Media shall meet or exceed the requirements of AWWA B100 and NSF Standard 61, including but not limited to the following material properties:

Parameter	Value	Unit
Effective Size	0.60 – 0.80	mm
Uniformity Coefficient	< 1.7	-
Specific Gravity	1.5 – 1.7	-
Acid Solubility	<5	percent
Bulk Density	~50	lb/cu ft
Hardness	>3	Mohs Scale

PART 3 EXECUTION

3.1 PLACEMENT AND CONDITIONING OF MEDIA

- A. Install filter media per AWWA B100-09.

3.2 COMMISSIONING

- A. See specification section 43 08 00 Commissioning of Process Systems.

END OF SECTION