

**OUTER DRIVE & WEST JUNEAU
WASTEWATER LIFT STATION
IMPROVEMENTS**

VOLUME I of II

Contract No. BE23-194

File No. 2124



ENGINEERING DEPARTMENT

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**DIVISION 0 - BIDDING AND CONTRACT REQUIREMENTS, CONTRACT FORMS, AND
CONDITIONS OF THE CONTRACT**

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DRAWINGS

See Cover Sheet of Drawings for Drawing Index

END OF SECTION

SECTION 00030 NOTICE INVITING BIDS

OBTAINING CONTRACT DOCUMENTS. The Contract Documents are entitled:

**Outer Drive & West Juneau Wastewater Lift Station Improvements
Contract No. BE23-194**

The Contract Documents may be downloaded from the CBJ Public Purchase webpage at <https://www.publicpurchase.com/juneau.ak>. Instructions for the Public Purchase registration process can be found here <https://juneau.org/engineering-public-works/bids-rfps>.

PRE-BID CONFERENCE. Prospective Bidders are encouraged to attend a pre-Bid conference to discuss the proposed WORK, which will be conducted by the OWNER, at 10:00 a.m. on February 2, 2023, via teleconference. The object of the conference is to acquaint Bidders with the project and bid documents. Proposers intending to participate via teleconference shall notify the Contracts Department at Contracts@Juneau.Org by 4:30 p.m., February 1, 2023.

DESCRIPTION OF WORK. The WORK covered in the Contract Documents includes retrofit of two wastewater lift stations (pump stations) including bypass pumping, cure-in-place pipe lining of 30-inch gravity sewer main, structural concrete modifications, miscellaneous metals fabrication for wastewater facilities, removal and replacement of; ductile iron process piping, sewer slide gates, access hatches and safety grating, metal ladders, miscellaneous process and drain piping, wastewater process valves, dry-pit submersible wastewater pumps, instrumentation, pump power supply and controls, potable water plumbing, HVAC ducting, unit heater and blower system, pump electrical gear, conduit and conductors, water level sensing devices and related equipment. Bypass pumping will be required to maintain wastewater service to the two associated sewer catchment areas, and one or more sewer service lines. Startup, commissioning, and performance optimizing of the two pump stations, and all ancillary work resulting in the functional performance of the pump stations is included.

ENGINEER'S ESTIMATE RANGE: Between \$3,500,000 and \$4,000,000.

COMPLETION OF WORK. The WORK must be completed by December 31, 2024.

DEADLINE FOR BIDDER QUESTIONS: 4:30pm Alaska Time on February 9, 2023.

DEADLINE FOR BIDS: Electronic bids must be received by the Purchasing Division **prior to 2:00 p.m., Alaska Time on February 16, 2023,** or such later time as may be announced by addendum at any time prior to the deadline. Bids will be opened immediately thereafter via conference call, unless otherwise specified. Bidders may attend this bid opening on the conference call line 907-713-2140, with participant code 258358.

SUBMISSION INSTRUCTIONS: Timely responses are accepted via Electronic Submission at Public Purchase, www.publicpurchase.com, the CBJ's eProcurement Provider. Bidders must register online prior to submitting a bid, it may take up to 24 hours for registration to be complete.

Late responses will not be accepted.

To Respond, Bidders must complete an online registration.

- Registration is a two-step process, registering with Public Purchase, and then registering with CBJ within Public Purchase.
- Get help registering using the [Public Purchase](#) Help Menu Tab.
- Register early to avoid missing the deadline, as Registration may take up to 24 hours to complete.

SECTION 00030 NOTICE INVITING BIDS

Registered Bidders may submit a Bid Schedule to Public Purchase by downloading the provided PDF solicitation documents, filling out the fields indicated, and uploading the document to Public Purchase.

SITE OF WORK. The site of the WORK is Outer Drive Wastewater Lift Station in downtown Juneau, Alaska and the West Juneau Wastewater Lift Station on Douglas Island, Juneau, Alaska.

BIDDING, CONTRACT, or TECHNICAL QUESTIONS. All communications relative to this WORK, prior to opening Bids, shall be directed to the following:

Greg Smith, Contract Administrator
CBJ Engineering Department, 3rd Floor, Marine View Center
Email: Greg.Smith@juneau.gov
Telephone: (907) 586-0800 ext. 4196
Fax: (907) 586-4530

BID SECURITY. Each Bid shall be accompanied by a certified or cashier's check or Bid Bond, in the amount of 5% percent of the Bid, payable to the City and Borough of Juneau, Alaska, as a guarantee that the Bidder, if its Bid is accepted, will promptly execute the Agreement. A Bid shall not be considered unless one of the forms of Bidder's security is provided as prescribed in Section 00100, Article 12, at the time of bid.

CONTRACTOR'S LICENSE. All contractors are required to have a current Alaska Contractor's License, prior to submitting a Bid, and a current Alaska Business License prior to award.

BID TO REMAIN OPEN. The Bidder shall guarantee the Bid for a period of 120 Days from the date of Bid opening. Any component of the Bid including additive alternates may be awarded anytime during the 120 Days.

OWNER'S RIGHTS RESERVED. The OWNER reserves the right to reject any or all Bids, to waive any informality in a Bid, and to make award to the lowest responsive, responsible Bidder as it may best serve the interests of the OWNER.

OWNER: City and Borough of Juneau

By: 

Greg Smith, Contract Administrator

1/25/23
Date

END OF SECTION

SECTION 00100 - INSTRUCTIONS TO BIDDERS

1.0 DEFINED TERMS. Terms used in these Instructions to Bidders and the Notice Inviting Bids, which are defined in the General Conditions, have the meanings assigned to them in the General Conditions. The term "Bidder" means one who submits a Bid directly to the OWNER, as distinct from a sub-bidder, who submits a Bid to a Bidder.

2.0 INTERPRETATIONS AND ADDENDA.

A. **INTERPRETATIONS.** All questions about the meaning or intent of the Contract Documents are to be directed to the Engineering Contracts Administrator. Interpretations or clarifications considered necessary by the Engineering Contracts Administrator in response to such questions will be issued by Addendum, mailed, faxed, or delivered to all parties recorded by the Engineering Contracts Administrator, or OWNER, as having received the Contract Documents. Questions received less than seven Days prior to the Deadline for Bids may not be answered. Only questions answered by formal written Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect.

B. **ADDENDA.** Addenda may be issued to modify the Contract Documents as deemed advisable by the OWNER. Addenda may be faxed or, if addendum format warrants, addenda may be posted to the CBJ Engineering Department website. In any event, notification of addendum issuance will be faxed to planholders. Hard copies are available upon request. The OWNER will make all reasonable attempts to ensure that all planholders receive notification of Addenda, however, it is strongly recommended by the OWNER that bidders independently confirm the contents, number, and dates of each Addendum prior to submitting a Bid.

3.0 FAIR COMPETITION. More than one Bid from an individual, firm, partnership, corporation, or association under the same or different names will not be considered. If the OWNER believes that any Bidder is interested in more than one Bid for the WORK contemplated, all Bids in which such Bidder is interested will be rejected. If the OWNER believes that collusion exists among the Bidders, all Bids will be rejected.

4.0 RESPONSIBILITY OF BIDDERS. Only responsive Bids from responsible Bidders will be considered. A Bid submitted by a Bidder determined to be not responsible may be rejected. The OWNER may find a bidder to be not responsible for any one of the following reasons, but is not limited in its responsibility analysis to the following factors:

- A. Evidence of bid rigging or collusion;
- B. Fraud or dishonesty in the performance of previous contracts;
- C. Record of integrity;
- D. More than one bid for the same work from an individual, firm, or corporation under the same or different name;
- E. Unsatisfactory performance on previous or current contracts;
- F. Failure to pay, or satisfactorily settle, all bills due for labor and material on previous contracts;

SECTION 00100 - INSTRUCTIONS TO BIDDERS

- G. Uncompleted work that, in the judgment of the OWNER, might hinder or prevent the bidder's prompt completion of additional work, if awarded;
- H. Failure to reimburse the OWNER for monies owed on any previous contracts;
- I. Default under previous contracts;
- J. Failure to comply with any qualification requirements of the OWNER; special standards for responsibility, if applicable, will be specified. These special standards establish minimum standards or experience required for a responsible Bidder on a specific contract;
- K. Engaging in any activity that constitutes a cause for debarment or suspension under the CBJ Procurement Code 53.50 or submitting a bid during a period of debarment;
- L. Lack of skill, ability, financial resources, or equipment required to perform the contract.
- M. Lack of legal capacity to contract.
- N. Bidders must be registered as required by law and in good standing for all amounts owed to the OWNER per Paragraph 21.0 of this Section.
- O. Failure to submit all completed documents as required and specified on the Bid Form, Section 00300.

Nothing contained in this section deprives the OWNER of its discretion in determining the lowest responsible bidder. Before a Bid is considered for award, a Bidder may be requested to submit information documenting its ability and competency to perform the WORK, according to general standards of responsibility and any special standards which may apply. It is Bidder's responsibility to submit sufficient, relevant, and adequate information. OWNER will make its determination of responsibility and has no obligation to request clarification or supplementary information.

5.0 NON-RESPONSIVE BIDS. Only responsive Bids will be considered. Bids may be considered non-responsive and may be rejected. Some of the reasons a Bid may be rejected for being non-responsive are:

- A. If a Bid is received by the CBJ Purchasing Division after the Deadline for Bids.
- B. If the Bid is on a form other than that furnished by the OWNER, or legible copies thereof; or if the form is altered or any part thereof is detached; or if the Bid is improperly signed.
- C. If there are unauthorized additions, conditional or alternate Bids, or irregularities of any kind which may tend to make the bid incomplete, indefinite, ambiguous as to its meaning, or in conflict with the OWNER's Bid document.
- D. If the Bidder adds any unauthorized conditions, limitations, or provisions reserving the right to accept or reject any award, or to enter into a contract pursuant to an award. This does not exclude a Bid limiting the maximum gross amount of awards acceptable to any one Bidder at any one Bid opening, provided that any selection of awards will be made by the OWNER.
- E. If the Bid does not contain a Unit Price for each pay item listed, except in the case of

SECTION 00100 - INSTRUCTIONS TO BIDDERS

authorized alternate pay items.

- F. If the Bidder has not acknowledged receipt of each Addendum.
- G. If the Bidder fails to furnish an acceptable Bid guaranty with the Bid.
- H. If any of the Unit Prices Bid are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the OWNER.
- I. If a Bid modification does not conform to Article 15.0 of this Section.
- J. Failure to submit all completed documents as required and specified on the Bid Form, Section 00300.

6.0 BIDDER'S EXAMINATION OF CONTRACT DOCUMENTS AND SITE. It is the responsibility of each Bidder before submitting a Bid:

- A. To examine thoroughly the Contract Documents, and other related data identified in the Bidding documents (including "technical data" referred to below):
 - 1. To visit the site to become familiar with and to satisfy the Bidder as to the general and local conditions that may affect cost, progress, or performance, of the WORK,
 - 2. To consider federal, state and local laws and regulations that may affect cost, progress, or performance of the WORK,
 - 3. To study and carefully correlate the Bidder's observations with the Contract Documents, and other related data; and
 - 4. To notify the ENGINEER of all conflicts, errors, or discrepancies in or between the Contract Documents and such other related data.

7.0 REFERENCE IS MADE TO THE SUPPLEMENTARY GENERAL CONDITIONS FOR IDENTIFICATION OF:

- A. Those reports of explorations and tests of subsurface conditions at the site which have been utilized by the Engineer of Record in the preparation of the Contract Documents. The Bidder may rely upon the accuracy of the technical data contained in such reports, however, the interpretation of such technical data, including any interpolation or extrapolation thereof, together with non-technical data, interpretations, and opinions contained therein or the completeness thereof is the responsibility of the Bidder.
- B. Those Drawings of physical conditions in or relating to existing surface and subsurface conditions (except underground utilities) which are at or contiguous to the site have been utilized by the Engineer of Record in the preparation of the Contract Documents. The Bidder may rely upon the accuracy of the technical data contained in such Drawings, however, the interpretation of such technical data, including any interpolation or extrapolation thereof, together with nontechnical data, interpretations, and opinions contained in such Drawings or the completeness thereof is the responsibility of the Bidder.
- C. Copies of such reports and Drawings will be made available by the OWNER to any Bidder on request if said reports and Drawings are not bound herein. Those reports and Drawings are not part of the Contract Documents, but the technical data contained therein upon

SECTION 00100 - INSTRUCTIONS TO BIDDERS

which the Bidder is entitled to rely, as provided in Paragraph SGC-4.2 of the Supplementary General Conditions, are incorporated herein by reference.

- D. Information and data reflected in the Contract Documents with respect to underground utilities at or contiguous to the site is based upon information and data furnished to the OWNER and the Engineer of Record by the owners of such underground utilities or others, and the OWNER does not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary General Conditions, or in Section 01530 - Protection and Restoration of Existing Facilities of the General Requirements.
- E. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, underground utilities and other physical conditions, and possible changes in the Contract Documents due to differing conditions appear in Paragraphs 4.2, 4.3, and 4.4 of the General Conditions.
- F. Before submitting a Bid, each Bidder will, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests, and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface, and underground utilities) at or contiguous to the site or otherwise which may affect cost, progress, or performance of the WORK and which the Bidder deems necessary to determine its Bid for performing the WORK in accordance with the time, price, and other terms and conditions of the Contract Documents.
- G. On request in advance, the OWNER will provide each Bidder access to the site to conduct such explorations and tests as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and shall clean up and restore the site to its former condition upon completion of such explorations.
- H. The lands upon which the WORK is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the CONTRACTOR in performing the WORK are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by the CONTRACTOR. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by the OWNER unless otherwise provided in the Contract Documents.
- I. The submission of a Bid will constitute an incontrovertible representation by the Bidder that the Bidder has complied with every requirement of Article 6.0, "Bidder's Examination of Contract Documents and Site" herein, that without exception the Bid is premised upon performing the WORK required by the Contract Documents and such means, methods, techniques, sequences, or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the WORK.

8.0 BID FORM.

- A. The Bid shall be made on the Bid Schedule(s) bound herein, or by another acceptable submission method as specified in Section 00030, Notice Inviting Bids, and shall contain the following: Sections 00300, 00310 or other specified acceptable form of Bid Schedule,

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the required Bid Security, and any other documents required in Section 00300 – Bid.

- B. All blanks on the Bid Form and Bid Schedule must be completed in ink or typed.
- C. Bids by corporations must be executed in the corporate name by the president, a vice-president (or other corporate officer). The corporate address and state of incorporation must appear below the signature.
- D. Bids by partnerships must be executed in the partnership name and be signed by a managing partner, and the official address of the partnership must appear below the signature.
- E. The Bidder's Bid must be signed. All names must be printed or typed below the signature.
- F. The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid form. Failure to acknowledge Addenda may render Bid non-responsive and may cause its rejection.
- G. The address to which communications regarding the Bid are to be directed must be shown.

9.0 QUANTITIES OF WORK. The quantities of WORK, or material, stated in Unit Price items of the Bid are supplied only to give an indication of the general scope of the WORK; the OWNER does not expressly or by implication agree that the actual amount of WORK, or material, will correspond therewith, and reserves the right after award to increase or decrease the amount of any Unit Price item of the WORK by an amount up to and including 25 percent of any Bid item, without a change in the Unit Price, and shall include the right to delete any Bid item in its entirety, or to add additional Bid items up to and including an aggregate total amount not to exceed 25 percent of the Contract Price (see Section 00700 - General Conditions, Article 10 Changes In the WORK).

10.0 SUBSTITUTE OR "OR-EQUAL" ITEMS. Substitution requests are not accepted during the bidding process. The procedure for the submittal of substitute or "or-equal" products is specified in Section 01300 – Contractor Submittals.

11.0 SUBMISSION OF BIDS. The Bid shall be delivered by the time and to the place stipulated in Section 00030 - Notice Inviting Bids. It is the Bidder's sole responsibility to see that its Bid is received in proper time. Hand-delivered, mailed, courier-delivered, oral, telegraphic, emailed, or faxed Bids will not be considered.

12.0 BID SECURITY, BONDS, AND INSURANCE. Each Bid shall be accompanied by a certified, or cashier's check, or approved Bid Bond in an amount of at least 5 percent of the total Bid price. The "total Bid price" is the amount of the Base Bid, plus the amount of alternate Bids, if any, which total to the maximum amount for which the CONTRACT could be awarded. Said check or Bond shall be made payable to the OWNER and shall be given as a guarantee that the Bidder, if offered the WORK, will enter into an Agreement with the OWNER, and will furnish the necessary insurance certificates, Payment Bond, and Performance Bond; each of said Bonds, if required, and insurance amounts shall be as stated in the Supplementary General Conditions. In case of refusal or failure to enter into said Agreement, the check or Bid Bond, as the case may be, may be forfeited to the OWNER. If the Bidder elects to furnish a Bid Bond as its Bid security, the Bidder shall use the Bid Bond form bound herein, or one conforming substantially to it in form. Bid Bonds must be accompanied by a legible Power of Attorney.

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Bid Bonds shall be submitted by being scanned and uploaded to Public Purchase along with the other required Bid documents. When a Bid security check is used, it must be received by the Purchasing Division prior to the Deadline for Bids. Bid security checks will be time and date stamped by the Purchasing Division, which will establish the official time of receipt.

In addition to uploading a scanned file of the Bid Bond, the original hardcopy Bid Bond shall be submitted and received by the CBJ Contracts Office by 2:00 p.m. Alaska Time no more than seven calendar days after Bid Opening.

In lieu of the original hardcopy Bid Bond submittal requirement, bidders who have a Surety 2000 Bid Bond ID may validate their Bid Bond with Surety 2000 within the Bid Bond Response Information Form in the Public Purchase bid page.

Bid security checks shall be submitted in a sealed envelope that clearly indicates: that a bid security check is enclosed, the name of the bidding firm, and the project name and number. The envelope must not reveal the check amount so that the final Bid price will not be known until the sealed bids are opened.

Bid security checks delivered **in person** or by **courier** service must be delivered to:

Bid security checks delivered by **U.S. Postal Service** must be mailed to:

PHYSICAL LOCATION:

City and Borough of Juneau, Purchasing Division
105 Municipal Way, Room 300
Juneau, AK 99801

MAILING ADDRESS:

City and Borough of Juneau, Purchasing Division
155 South Seward Street
Juneau, AK 99801

Mailing/delivery times to Alaska may take longer than other areas of the U.S. Late bid security checks may cause a Bid to be deemed non-responsive

13.0 RETURN OF BID SECURITY. The OWNER will return all Bid security checks (certified or cashier's) accompanying such of the Bids as are not considered in making the award. All other Bid securities will be held until the Agreement has been executed. Following execution of the Agreement, all other Bid security checks will be returned to the respective Bidders whose Bids they accompanied and Bid security bonds will be appropriately discarded.

14.0 DISCREPANCIES IN BIDS. In the event there is more than one Pay Item in a Bid Schedule, the Bidder shall furnish a price for all Pay Items in the schedule, and failure to do so may render the Bid non-responsive and cause its rejection. In the event there are Unit Price Pay Items in a Bid Schedule and the "amount" indicated for a Unit Price Bid Item does not equal the product of the Unit Price and quantity, the Unit Price shall govern and the amount will be corrected accordingly, and the Bidder shall be bound by said correction. In the event there is more than one Pay Item in a Bid Schedule and the total indicated for the schedule does not agree with the sum of the prices Bid on the individual items, the prices Bid on the individual items shall govern and the total for the schedule will be corrected accordingly, and the Bidder shall be bound by said correction.

15.0 BID MODIFICATIONS AND UNAUTHORIZED ALTERNATIVE BIDS.

A. Any bidder may deliver a modification to a bid in person, by mail or fax (907-586-4561), provided that such modification is received by the Purchasing Division no later than the

SECTION 00100 - INSTRUCTIONS TO BIDDERS

deadline for bids. Modifications will be time and date stamped by the Purchasing Division, which will establish the official time of receipt of the modification. The modification must not reveal the bid price but should be in the form of an addition or subtraction or other modification so that the final prices will not be known until the sealed bid is opened.

The Bid modifications shall be provided on the **Bid Modification Form** located at the end of this Section. Submittal of any other form by the vendor may deem the modification unacceptable by the OWNER. **A mail or fax modification should not reveal the Bid price but should provide the addition or subtraction or other modification so that the final prices will not be known by the City and Borough until the sealed Bid is opened.** Submitted Modification forms shall include the modification to the unit price or lump sum amount of each pay item modified.

FAX DISCLAIMER: It is the responsibility of the bidder to submit modifications in a timely manner. Bidders' use of a fax machine to modify their bid shall be at bidders' sole risk. The Purchasing Division will attempt to keep the fax machine in good working order but will not be responsible for bid modifications that are late due to mechanical failure, a busy fax machine, or any other cause arising from bidder's use of a fax machine, even if bidder submits a transmission report or provides other confirmation indicating that the bidder transmitted a bid modification prior to the deadline. The City will not be responsible for its failure to receive the modification whether such failure is caused by equipment or human error, or otherwise. Bidders are therefore strongly encouraged to confirm receipt of their bid modification with the Purchasing Division (907-586-5215) prior to deadline.

- B. Conditioned bids, limitations, or provisos attached to the Bid or bid modification will render it unauthorized and cause its rejection as being non-responsive. The completed Bid forms shall be without interlineations, alterations, or erasures in the printed text. All changes shall be initialed by the person signing the Bid. Alternative Bids will not be considered unless called for.

16.0 WITHDRAWAL OF BID. Prior to the Deadline for Bids, the Bid may be withdrawn by the Bidder by means of a written request, signed by the Bidder or its properly authorized representative. Such written request must be delivered to the place stipulated in the Notice Inviting Bids for receipt of Bids.

17.0 AWARD OF CONTRACT.

- A. Award of a contract, if it is awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Technical Specifications and will be made to the lowest responsive, responsible Bidder whose Bid complies with all the requirements prescribed. Unless otherwise specified, any such award will be made within the period stated in the Notice Inviting Bids that the Bids are to remain open. Unless otherwise indicated, a single award will be made for all the Bid items in an individual Bid Schedule.
- B. If the OWNER has elected to advertise this Project with a Base Bid and Alternates, the OWNER may elect to award the contract for the Base Bid, or the Base Bid in combination with one or more Alternates selected by the OWNER. In either case, award shall be made to the responsive, responsible bidder offering the lowest total Bid for the WORK to be awarded.

SECTION 00100 - INSTRUCTIONS TO BIDDERS

- C. Low Bidder will be determined on the basis of the lowest total of the Base Bid plus combinations of Alternates if funding allows, as selected by the Selection Committee through the process described below.
- 1 Prior to the Deadline for Bids, a Selection Committee will be appointed by the Owner.
 - 2 The Selection Committee will be sequestered in a conference room apart from the bid opening room at the time of bid opening.
 - 3 The CBJ Purchasing staff will open bids. A bid summary sheet will be compiled without bidder identification, so that the Selection Committee will have no knowledge of which bids were made by which bidders.
 - 4 The bid summary sheet will be delivered to the Selection Committee by the Engineering Contract Administrator.
 - 5 The Selection Committee will choose the low bid comprised of the Base Bid and those Alternates deemed to be in the best interest of the project and within the approved construction budget. For award purposes, the CBJ will add any Alternate to the Total Base Bid Amount in Section 00310 – Bid Schedule.
 - 6 The Selection Committee will identify in order from low to high the bids received for the project and the results will be posted.
- D. Award of a contract is subject to the adoption of an appropriation of funds by the City Assembly.

18.0 EXECUTION OF AGREEMENT.

- A. All Bids of value greater than \$1,000,000 must be approved by the CBJ Assembly. After the CBJ Assembly has approved the award and after the Bid protest period, the OWNER will issue a Notice of Intent to Award to the approved Bidder. The Bidder to whom award is made shall execute a written Agreement with the OWNER on the Agreement form, Section 00500, collect insurance, and shall furnish all certificates and Bonds required by the Contract Documents within 10 Days (calendar) from the date of the Notice of Intent to Award letter.
- B. Failure or refusal to enter into the Agreement as herein provided or to conform to any of the stipulated requirements in connection therewith shall be just cause for annulment of the award and forfeiture of the Bid security. If the lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the contract to the second lowest responsive, responsible Bidder. If the second lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the contract to the third lowest responsive, responsible Bidder. On the failure or refusal of such second or third lowest Bidder to execute the Agreement, each such Bidder's Bid securities shall be likewise forfeited to the OWNER.

19.0 LIQUIDATED DAMAGES. Provisions for liquidated damages if any, are set forth in Section 00500 - Agreement.

20.0 FILING A PROTEST.

- A. A Bidder may protest the proposed award of a competitive sealed Bid by the City and

SECTION 00100 - INSTRUCTIONS TO BIDDERS

Borough of Juneau. The protest shall be executed in accordance with CBJ Ordinance 53.50.062 PROTESTS and CBJ Ordinance 53.50.080 ADMINISTRATION OF PROTEST. The entire text of the CBJ Purchasing Ordinance can be accessed at the CBJ website, <http://www.juneau.org/law/code/code.php>, or call the CBJ Purchasing Division at (907) 586-5215 for a copy of the ordinance.

B. Late protests shall not be considered by the CBJ Purchasing Officer.

21.0 CONTRACTOR'S GOOD STANDING WITH CBJ FINANCE DEPARTMENT: Contractors must be in good standing with the CBJ prior to award, and prior to any contract renewals, and in any event no later than seven business days following notification by the CBJ of intent to award. **Good standing** means: all amounts owed to the CBJ are current and the Contractor is not delinquent with respect to any taxes, fees, assessment, or other monies due and owed the CBJ, or a Confession of Judgment has been executed and the Contractor is in compliance with the terms of any stipulation associated with the Confession of Judgment, including being current as to any installment payments due; and Contractor is current in all CBJ reporting obligations (such as sales tax registration and reporting and business personal property declarations). Failure to meet these requirements may be cause for rejection of your bid. To determine if your business is in good standing, or for further information, contact the CBJ Finance Department's Sales Tax Division at (907) 586-5215 for sales tax issues, Assessor's Office at (907)586-5215 for business personal property issues, or Collections Division at (907) 586-5215 for all other accounts.

22.0 PERMITS AND LICENSES. The CONTRACTOR is responsible for all WORK associated with meeting any local, state, and/or federal permit and licensing requirements.

SECTION 00100 - INSTRUCTIONS TO BIDDERS

CITY AND BOROUGH OF JUNEAU
PURCHASING DIVISION
FAX NO. 907-586-4561

BID MODIFICATION FORM

Modification Number: _____

Modification Page ____ of ____

Note: All modifications shall be made to the original bid amount(s). If more than one Modification form is submitted by any one bidder, changes from all Modification forms submitted will be combined and applied to the original bid. Changes to the modified Bid amounts will be calculated by the OWNER. Bidder may use multiple modification pages if required.

PAY ITEM NO.	PAY ITEM DESCRIPTION	MODIFICATIONS TO UNIT PRICE (<i>indicate +/-</i>)

Base Bid Total Increase or Decrease: \$ _____

PAY ITEM No.	ALTERNATE PAY ITEM DESCRIPTION	MODIFICATIONS TO UNIT PRICE (<i>indicate +/-</i>)
333220.1	Spare Dry Weather Pump - Outer Drive	
333220.1a	Spare Wet Weather Pump - Outer Drive	
333220.2	Spare Pump - West Juneau	

Alternate Total Increase or Decrease: \$ _____

Name of Bidding Firm

Responsible Party Signature

Printed Name (must be an authorized signatory for Bidding Firm)

END OF SECTION

SECTION 00300 - BID

BID TO: THE CITY AND BOROUGH OF JUNEAU

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with the OWNER on the form included in the Contract Documents (as defined in Article 7 of Section 00500 - Agreement) to perform the WORK as specified or indicated in said Contract Documents entitled

**Outer Drive & West Juneau Wastewater Lift Station Improvements
Contract No. BE23-194**

2. Bidder accepts all of the terms and conditions of the Contract Documents, including without limitation those in the "Notice Inviting Bids" and "Instructions to Bidders," dealing with the disposition of the Bid Security.
3. This Bid will remain open for the period stated in the "Notice Inviting Bids" unless otherwise required by law. Bidder will enter into an Agreement within the time and in the manner required in the "Notice Inviting Bids" and the "Instructions to Bidders," and will furnish insurance certificates, Payment Bond, Performance Bond, and any other documents as may be required by the Contract Documents.
4. Bidder has familiarized itself with the nature and extent of the Contract Documents, WORK, site, locality where the WORK is to be performed, the legal requirements (federal, state and local laws, ordinances, rules, and regulations), and the conditions affecting cost, progress or performance of the WORK and has made such independent investigations as Bidder deems necessary.
5. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.
6. To all the foregoing, and including all Bid Schedule and information required of Bidder contained in this Bid Form, said Bidder further agrees to complete the WORK required under the Contract Documents within the Contract Time stipulated in said Contract Documents, and to accept in full payment therefore the Contract Price based on the total bid price(s) named in the aforementioned Bid Schedule.
7. Bidder has examined copies of all the Contract Documents including the following Addenda (receipt of all of which is hereby acknowledged by the Undersigned):

Addenda No.	Date Issued	Addenda No.	Date Issued

Give number and date of each Addenda above. Failure to acknowledge receipt of all Addenda may cause the Bid to be non-responsive and may cause its rejection.

SECTION 00300 - BID

8. The Bidder has read this Bid and agrees to the conditions as stated herein by signing its signature in the space provided below.

Dated: _____	Bidder: _____ (Company Name)
Alaska CONTRACTOR's Business License No: _____	By: _____ (Signature)
Alaska CONTRACTOR's License No: _____	Printed Name: _____ Title: _____
Telephone No: _____	Address: _____ (Street or P.O. Box)
Fax No: _____	_____ (City, State, Zip)
E-mail: _____	

9. **TO BE CONSIDERED, ALL BIDDERS MUST COMPLETE AND INCLUDE THE FOLLOWING AT THE TIME OF THE DEADLINE FOR BIDS. MISSING DOCUMENTS WILL DEEM THIS BID NON-RESPONSIVE:**

- Bid, Section 00300 (includes Addenda receipt statement)
- Completed Bid Schedule, Section 00310, or other acceptable form of Bid Schedule as specified in Section 00030, Notice Inviting Bids
- Bid Security (Bid Bond, Section 00320, or by a certified or cashier's check as stipulated in the Notice Inviting Bids, Section 00030)
- **Contractor Financial Responsibility, Section 00370**

10. The apparent low Bidder is required to complete and submit the following documents by 4:30 p.m. on the ***fifth business day*** following the date of the Posting Notice.

- Subcontractor Report, Section 00360

The apparent low Bidder who fails to submit the completed Subcontractor Report within the time specified in Section 00360 – Subcontractor Report, may be found to be not a responsible Bidder and may be required to forfeit the Bid security. The OWNER may then consider the next lowest Bidder for award of the contract.

11. The successful Bidder will be required to submit, ***within ten Days (calendar)*** after the date of the “Notice of Intent to Award” letter, the following executed documents:

- Agreement Forms, Section 00500
- Performance Bond, Section 00610
- Payment Bond, Section 00620
- Certificates of Insurance, (CONTRACTOR) Section 00700 and Section 00800

END OF SECTION

SECTION 00310 - BID SCHEDULE

PAY ITEM NO.	PAY ITEM DESCRIPTION	PAY UNIT	APPROX. QUANTITY	UNIT PRICE		AMOUNT	
				DOLLARS	CENTS	DOLLARS	CENTS
01505	Mobilization	Lump Sum	All Req'd	Lump	Sum		
01550	Traffic Control	Lump Sum	All Req'd	Lump	Sum		
01570	Erosion and Sediment Control	Lump Sum	All Req'd	Lump	Sum		
02203.1	Trenching	Lump Sum	All Req'd	Lump	Sum		
02401	Rehabilitation by Cured-In-Place Pipe (CIPP) Lining,	LF	50				
02702	Construction Surveying	Lump Sum	All Req'd	Lump	Sum		
03301.1	Structural Concrete - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
03301.2	Structural Concrete - West Juneau	Lump Sum	All Req'd	Lump	Sum		
011537.1	Bypass Pumping - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
015137.2	Bypass Pumping - West Juneau	Lump Sum	All Req'd	Lump	Sum		
024100.1	Demolition - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
024100.2	Demolition - West Juneau	Lump Sum	All Req'd	Lump	Sum		
055000.1	Miscellaneous Metals - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
055000.2	Miscellaneous Metals - West Juneau	Lump Sum	All Req'd	Lump	Sum		
080000.1	Openings - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
080000.2	Openings - West Juneau	Lump Sum	All Req'd	Lump	Sum		
220000.1	Plumbing - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
220000.2	Plumbing - West Juneau	Lump Sum	All Req'd	Lump	Sum		
230000.1	Heating, Ventilation, and AC Systems - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
230000.2	Heating, Ventilation, and AC Systems - West Juneau	Lump Sum	All Req'd	Lump	Sum		
260000.1	Electrical Improvements - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
260000.2	Electrical Improvements - West Juneau	Lump Sum	All Req'd	Lump	Sum		
333220.1	Dry Pit Submersible Pumps - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
333220.2	Dry Pit Submersible Pumps - West Juneau	Lump Sum	All Req'd	Lump	Sum		
400500.1	Process Piping, Valves, and Appurtenances - Outer Dr	Lump Sum	All Req'd	Lump	Sum		

SECTION 00310 - BID SCHEDULE

PAY ITEM NO.	PAY ITEM DESCRIPTION	PAY UNIT	APPROX. QUANTITY	UNIT PRICE		AMOUNT	
				DOLLARS	CENTS	DOLLARS	CENTS
400500.2	Process Piping, Valves, and Appurtenances - West Jun	Lump Sum	All Req'd	Lump	Sum		
406100.1	Process Control and Instrumentation - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
406100.2	Process Control and Instrumentation - West Juneau	Lump Sum	All Req'd	Lump	Sum		
410000.1	Processing and Handling Equipment - Outer Drive	Lump Sum	All Req'd	Lump	Sum		
410000.2	Processing and Handling Equipment - West Juneau	Lump Sum	All Req'd	Lump	Sum		

TOTAL BASE BID: _____

COMPANY NAME: _____

Additive Alternate No. 1				UNIT PRICE		AMOUNT	
PAY ITEM NO.	PAY ITEM DESCRIPTION	PAY UNIT	APPROX. QUANTITY	DOLLARS	CENTS	DOLLARS	CENTS
333220.1	Spare Dry Weather Pump - Outer Drive	EA	1				

TOTAL ADDITIVE ALTERNATE NO. 1 BID _____

COMPANY NAME: _____

Additive Alternate No. 2				UNIT PRICE		AMOUNT	
PAY ITEM NO.	PAY ITEM DESCRIPTION	PAY UNIT	APPROX. QUANTITY	DOLLARS	CENTS	DOLLARS	CENTS
333220.1a	Spare Wet Weather Pump - Outer Drive	EA	1				

TOTAL ADDITIVE ALTERNATE NO. 2 BID _____

COMPANY NAME: _____

Additive Alternate No. 3				UNIT PRICE		AMOUNT	
PAY ITEM NO.	PAY ITEM DESCRIPTION	PAY UNIT	APPROX. QUANTITY	DOLLARS	CENTS	DOLLARS	CENTS
333220.2	Spare Pump- West Juneau	EA	1				

TOTAL ADDITIVE ALTERNATE NO. 3 BID _____

COMPANY NAME: _____

SECTION 00320 - BID BOND

KNOW ALL PERSONS BY THESE PRESENTS, that _____
_____ as Principal, and _____
as Surety, are held and firmly bound unto **THE CITY AND BOROUGH OF JUNEAU** hereinafter called
"OWNER," in the sum of _____
_____ dollars, (not less than five percent of the total amount of the Bid) for the
payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators,
successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under
the Bid Schedule of the OWNER's Contract Documents entitled.

**Outer Drive & West Juneau Wastewater Lift Station Improvements
Contract No. BE23-194**

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and
in the manner required in the "Notice Inviting Bids" and the "Instructions to Bidders" enters into a written
Agreement on the form of Agreement bound with said Contract Documents, furnishes the required certificates
of insurance, and furnishes the required Performance Bond and Payment Bond, then this obligation shall be
null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by
said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit,
including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this _____ day of _____, 20__

(SEAL) _____
(Principal)

(SEAL) _____
(Surety)

By: _____
(Signature)

By: _____
(Signature)

END OF SECTION

SECTION 00360 - SUBCONTRACTOR REPORT

LIST OF SUBCONTRACTORS (AS 36.30.115)

The apparent low Bidder must submit a list of Subcontractors that the Bidder proposes to use in the performance of this contract *on the fifth business day* following the Posting Notice of Bids. If the fifth day falls on a weekend or holiday, the report is due by close of business on the next business Day following the weekend or holiday. The Subcontractor Report list must include each Subcontractor's name, address, location, evidence of valid Alaska Business License, and valid Alaska Contractor's Registration under AS 08.18. *If no Subcontractors are to be utilized in the performance of the WORK, write in ink or type "NONE" on line (1) below.*

<u>SUBCONTRACTOR</u>	¹ AK Contractor <u>License No.</u>	¹ <u>Contact Name</u>	<u>Type of</u>	<u>Contract</u>	✓ if <u>DBE</u>
<u>ADDRESS</u>	² AK Business <u>License No.</u>	² <u>Phone No.</u>	<u>Work</u>	<u>Amount</u>	
1. _____ _____ _____	1 _____ 2 _____	_____ _____	_____ _____	\$ _____	<input type="checkbox"/>
2. _____ _____ _____	1 _____ 2 _____	_____ _____	_____ _____	\$ _____	<input type="checkbox"/>
3. _____ _____ _____	1 _____ 2 _____	_____ _____	_____ _____	\$ _____	<input type="checkbox"/>
4. _____ _____ _____	1 _____ 2 _____	_____ _____	_____ _____	\$ _____	<input type="checkbox"/>

I certify that the above listed Alaska Business License(s) and CONTRACTOR Registration(s), if applicable, were valid at the time Bids were opened for this Project.

CONTRACTOR, Authorized Signature

CONTRACTOR, Printed Name

COMPANY

SECTION 00360 - SUBCONTRACTOR REPORT

- A. A Bidder may replace a listed Subcontractor if the Subcontractor:
1. fails to comply with AS 08.18;
 2. files for bankruptcy or becomes insolvent;
 3. fails to execute a contract with the Bidder involving performance of the WORK for which the Subcontractor was listed and the Bidder acted in good faith;
 4. fails to obtain bonding;
 5. fails to obtain insurance acceptable to the OWNER;
 6. fails to perform the contract with the Bidder involving work for which the Subcontractor was listed;
 7. must be substituted in order for the CONTRACTOR to satisfy required state and federal affirmative action requirements;
 8. refuses to agree or abide with the Bidder's labor agreement; or
 9. is determined by the OWNER not to be responsible.
 10. is not in "Good Standing" with the OWNER as required in Article 21.0 in Section 00100 – Instructions to Bidders.
- B. If a Bidder fails to list a Subcontractor or lists more than one Subcontractor for the same portion of WORK, the Bidder shall be considered to have agreed to perform that portion of WORK without the use of a Subcontractor and to have represented the Bidder to be qualified to perform that WORK.
- C. A Bidder who attempts to circumvent the requirements of this section by listing as a Subcontractor another contractor who, in turn, sublets the majority of the WORK required under the contract violates this section.
- D. If a contract is awarded to a Bidder who violates this section, the OWNER may:
1. cancel the contract; or
 2. after notice and a hearing, assess a penalty on the Bidder in an amount that does not exceed 10 percent of the value of the subcontract at issue.
- E. On the Subcontractor Report, the apparent low Bidder must list all Subcontractors anticipated to perform WORK on the project.
- F. An apparent low Bidder who fails to submit a completed Subcontractor Report within the time specified in this section may be found to be not a responsible Bidder and may be required to forfeit the Bid security. The OWNER will then consider the next lowest Bidder for award of the contract.

END OF SECTION

SECTION 00370 - CONTRACTOR'S FINANCIAL RESPONSIBILITY

To be considered, all bidders must complete and include this form *at the time of the deadline for bids*. Attach additional sheets as necessary to respond to questions.

PROJECT: Outer Drive & West Juneau Wastewater Lift Station Improvements

As the General Contractor on this project, I intend to subcontract _____% of the total value of this contract.

A. EXPERIENCE

1. Have you ever failed to complete a contract due to insufficient resources?

No Yes If YES, explain:

2. Describe arrangements you have made to finance this work:

3. Have you had previous construction contracts or subcontracts with the City and Borough of Juneau?

Yes No

4. Describe your most recent or current contract, its completion date, and scope of work:

5. List below, and/or as an attachment to this questionnaire, other construction projects you have completed, dates of completion, scope of work, and total contract amount for each project completed in the past twelve months.

SECTION 00370 - CONTRACTOR'S FINANCIAL RESPONSIBILITY

6. Per Alaska Statute 36.90.210, on previously awarded public contracts (including contracts still in progress), have you ever failed to pay a subcontractor or material supplier within eight working days after receiving payment from the Owner (for projects occurring within the last 3 years)?

Yes No If yes, please attach a detailed explanation for each occurrence.

B. EQUIPMENT

1. Describe below, and/or as an attachment, the equipment you have available and intend to use for this project.

ITEM	QUANTITY	MAKE	MODEL	SIZE/CAPACITY	PRESENT MARKET VALUE

2. Do you propose to purchase any equipment for use on this project not listed on table B-1?

No Yes If YES, describe type, quantity, and approximate cost:

3. Do you propose to rent any equipment for this work not listed on table B-1?

No Yes If YES, describe type and quantity:

SECTION 00370 - CONTRACTOR'S FINANCIAL RESPONSIBILITY

4. Is your bid based on firm offers for all materials necessary for this project?

Yes No If NO, please explain:

I hereby certify that the above statements are true and complete.

Signature

Company Name

Printed Name

Date

SECTION 00500 - AGREEMENT

THIS AGREEMENT is between THE CITY AND BOROUGH OF JUNEAU (hereinafter called OWNER) and _____ (hereinafter called CONTRACTOR) OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1. WORK.

CONTRACTOR shall complete the WORK as specified or as indicated under the Bid Schedule of the OWNER's Bid Documents entitled Contract No. BE23-194- Outer Drive & West Juneau Wastewater Lift Station Improvements.

The WORK covered in the Contract Documents includes retrofit of two wastewater lift stations (pump stations) including bypass pumping, cure-in-place pipe lining of 30-inch gravity sewer main, structural concrete modifications, miscellaneous metals fabrication for wastewater facilities, removal and replacement of; ductile iron process piping, sewer slide gates, access hatches and safety grating, metal ladders, miscellaneous process and drain piping, wastewater process valves, dry-pit submersible wastewater pumps, instrumentation, pump power supply and controls, potable water plumbing, HVAC ducting, unit heater and blower system, pump electrical gear, conduit and conductors, water level sensing devices and related equipment. Bypass pumping will be required to maintain wastewater service to the two associated sewer catchment areas, and one or more sewer service lines. Startup, commissioning, and performance optimizing of the two pump stations, and all ancillary work resulting in the functional performance of the pump stations is included..

The WORK to be paid under this contract shall include the following: Base Bid and Additive Alternates as shown in Section 00310 - Bid Schedule.

ARTICLE 2. CONTRACT COMPLETION TIME.

The WORK must be completed by December 31, 2024.

ARTICLE 3. DATE OF AGREEMENT

The date of this Agreement will be the date of the last signature on page three of this section.

ARTICLE 4. LIQUIDATED DAMAGES.

OWNER and the CONTRACTOR recognize that time is of the essence of this Agreement and that the OWNER will suffer financial loss if the WORK is not completed within the time specified in Article 2 herein, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense, and difficulties involved in proving in a legal proceeding the actual damages suffered by the OWNER if the WORK is not completed on time. Accordingly, instead of requiring any such proof, the OWNER and the CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) the CONTRACTOR shall pay the OWNER \$1,000 for each Day that expires after the completion time specified in Article 2 herein. The amount of liquidated damages specified above is agreed to be a reasonable estimate based on all facts known as of the date of this Agreement.

ARTICLE 5. CONTRACT PRICE.

OWNER shall pay CONTRACTOR for completion of the WORK in accordance with the Contract Documents in the amount set forth in the Bid Schedule. The CONTRACTOR agrees to accept as full and complete payment for all WORK to be done in this contract for: Contract No. BE23-194 Outer Drive & West Juneau Wastewater Lift Station Improvements. those Unit Price amounts as set forth in the Bid Schedule in the Contract Documents for this Project.

**OUTER DRIVE & WEST JUNEAU
LIFT STATION IMPROVEMENTS
Contract No. BE23-194**

**AGREEMENT
Page 00500-1**

SECTION 00500 - AGREEMENT

The total amount of this contract shall be _____ (\$ _____), except as adjusted in accordance with the provisions of the Bid Documents.

ARTICLE 6. PAYMENT PROCEDURES.

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by the ENGINEER as provided in the General Conditions.

Progress payments will be paid in full in accordance with Article 14 of the General Conditions until ninety (90) percent of the Contract Price has been paid. The remaining ten (10) percent of the Contract Price may be retained, in accordance with applicable Alaska State Statutes, until final inspection, completion, and acceptance of the Project by the OWNER.

ARTICLE 7. CONTRACT DOCUMENTS.

The Contract Documents which comprise the entire Agreement between OWNER and CONTRACTOR concerning the WORK consist of this Agreement (pages 00500-1 to 00500-6, inclusive) and the following sections of the Contract Documents:

- Table of Contents (pages 00005-1, inclusive)
- Notice Inviting Bids (pages 00030-1 to 00030-2, inclusive).
- Instructions to Bidders (pages 00100-1 to 00100-10, inclusive).
- Bid (pages 00300-1 to 00300-2, inclusive).
- Bid Schedule (pages 00310-1 to 00310-2, inclusive).
- Bid Bond (page 00320-1, inclusive) or Bid Security.
- Subcontractor Report (pages 00360-1 to 00360-2, inclusive).
- Contractor Financial Responsibility (pages 00370-1 to 00370-3, inclusive).
- Performance Bond (pages 00610-1 to 00610-2, inclusive).
- Payment Bond (pages 00620-1 to 00620-2, inclusive).
- Insurance Certificate(s).
- General Conditions (pages 00700-1 to 00700-48, inclusive).
- Supplementary General Conditions (pages 00800-1 to 00800-6, inclusive).
- Alaska Labor Standards, Reporting, and Prevailing Wage Determination (page 00830-1).
- Permits, (page 00852-1, inclusive).
- Standard Details (page 00853-1).
- Special Provisions (pages 1 to 346 inclusive)
- Drawings consisting of 81 sheets, as listed in the Table of Contents.
- Addenda numbers ____ to ____, inclusive.
- Change Orders which may be delivered or issued after the Date of the Agreement and which are not attached hereto.

There are no Contract Documents other than those listed in this Article 7. The Contract Documents may only be amended by Change Order as provided in Paragraph 3.3 of the General Conditions.

ARTICLE 8. MISCELLANEOUS.

Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

SECTION 00500 - AGREEMENT

ARTICLE 8. MISCELLANEOUS. (Cont'd.)

No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents. This Agreement shall be governed by the laws of the State of Alaska. Jurisdiction shall be in the State of Alaska, First Judicial District.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have caused this Agreement to be executed on the date listed below by OWNER.

OWNER:

CONTRACTOR:

City and Borough of Juneau

(Company Name)

(Signature)

(Signature)

By: Duncan Rorie Watt, City & Borough Manager
(Printed Name)

By: _____
(Printed Name, Authority or Title)

Date: _____

CONTRACTOR Signature Date: _____

OWNER's address for giving notices:

CONTRACTOR's address for giving notices:

155 South Seward Street

Juneau, Alaska 99801

907-586-0800 907-586-4530
(Telephone) (Fax)

(Telephone) (Fax)

(E-mail address)

Contractor License No. _____

SECTION 00500 - AGREEMENT

CERTIFICATE
(if Corporation)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Board of Directors of the
_____ a corporation existing under the laws of
the State of _____, held on _____, 20____, the following resolution
was duly passed and adopted:

“RESOLVED, that _____, as _____ President
of the Corporation, be and is hereby authorized to **execute the Agreement** with the CITY AND
BOROUGH OF JUNEAU and this corporation and that the execution thereof, attested by the
Secretary of the Corporation, and with the Corporate Seal affixed, shall be the official act and deed
of this Corporation.”

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the
corporation this _____ day of _____, 20_____.

Secretary

(SEAL)

SECTION 00500 - AGREEMENT

CERTIFICATE
(if Partnership)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Partners of the _____ a partnership existing under the laws of the State of _____, held on _____, 20____, the following resolution was duly passed and adopted:

"RESOLVED, that _____, as _____ of the Partnership, be and is hereby authorized to **execute the Agreement** with the CITY AND BOROUGH OF JUNEAU and this partnership and that the execution thereof, attested by the _____ shall be the official act and deed of this Partnership."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of _____, 20_____.

Secretary

(SEAL)

SECTION 00500 - AGREEMENT

CERTIFICATE
(if Joint Venture)

STATE OF)
) SS:
COUNTY OF)

I HEREBY CERTIFY that a meeting of the Principals of the
_____ a joint venture existing under the laws of the
State of _____, held on _____, 20____, the following resolution was duly passed and
adopted:

"RESOLVED, that _____, as _____ of the
Joint Venture, be and is hereby authorized to **execute the Agreement** with the CITY AND
BOROUGH OF JUNEAU and this joint venture and that the execution thereof, attested by the
_____ shall be the official act and deed of this Joint Venture."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of
_____, 20____.

Secretary

(SEAL)

END OF SECTION

SECTION 00610 - PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS: That we _____
(Name of Contractor)

_____ a _____
(Corporation, Partnership, Individual)

hereinafter called "Principal" and _____
(Surety)

of _____, State of _____ hereinafter called the "Surety," are held and
firmly bound to the CITY AND BOROUGH of JUNEAU, ALASKA hereinafter called "OWNER,"
(Owner) (City and State)

for the penal sum of _____

_____ dollars (\$ _____) in lawful money of the
United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors,
administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the CONTRACTOR has entered
into a certain contract with the OWNER, the effective date of which is (CBJ Contracts Office to fill in effective
date) _____, a copy of which is hereto attached and made a part hereof for the
construction of:

**Outer Drive & West Juneau Wastewater Lift Station Improvements
CBJ Contract No. BE23-194**

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

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

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

SECTION 00610 - PERFORMANCE BOND

**Outer Drive & West Juneau Wastewater Lift Station Improvements
CBJ Contract No. BE23-194**

IN WITNESS WHEREOF, this instrument is issued in two (2) identical counterparts, each one of which shall be deemed an original.

CONTRACTOR:

By: _____
(Signature)

(Printed Name)

(Company Name)

(Mailing Address)

(City, State, Zip Code)

SURETY:

By: _____
(Signature of Attorney-in-Fact)

Date Issued: _____

(Printed Name)

(Company Name)

(Mailing Address)

(City, State, Zip Code)

(Affix SURETY'S SEAL)

NOTE: If CONTRACTOR is Partnership, all Partners must execute bond.

END OF SECTION

SECTION 00620 - PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENTS: That we _____
(Name of Contractor)

_____ a _____
(Corporation, Partnership, Individual)

hereinafter called "Principal" and _____
(Surety)

of _____, State of _____ hereinafter called the "Surety," are held and
firmly bound to the CITY AND BOROUGH of JUNEAU, ALASKA hereinafter called "OWNER,"
(Owner) (City and State)

for the penal sum of _____

_____ dollars (\$ _____) in lawful money of the
United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors,
administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the CONTRACTOR has entered
into a certain contract with the OWNER, the effective date of which is (CBJ Contracts Office to fill in effective
date) _____, a copy of which is hereto attached and made a part hereof for the
construction of:

**Outer Drive & West Juneau Wastewater Lift Station Improvements
CBJ Contract No. BE23-194**

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

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

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

SECTION 00620 - PAYMENT BOND

**Outer Drive & West Juneau Wastewater Lift Station Improvements
CBJ Contract No. BE23-194**

IN WITNESS WHEREOF, this instrument is issued in two (2) identical counterparts, each one of which shall be deemed an original.

CONTRACTOR:

By: _____
(Signature)

(Printed Name)

(Company Name)

(Mailing Address)

(City, State, Zip Code)

SURETY:

By: _____
(Signature of Attorney-in-Fact)

Date Issued: _____

(Printed Name)

(Company Name)

(Mailing Address)

(City, State, Zip Code)

(Affix SURETY'S SEAL)

NOTE: If CONTRACTOR is Partnership, all Partners must execute bond.

END OF SECTION

SECTION 00700 - GENERAL CONDITIONS

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SECTION 00700 - GENERAL CONDITIONS

ARTICLE 1 DEFINITIONS

Wherever used in these General Conditions or in the Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof. Where an entire word is capitalized in the definitions and is found not capitalized in the Contract Documents it has the ordinary dictionary definition.

Addenda - Written or graphic instruments issued prior to the opening of Bids which make additions, deletions, or revisions to the Contract Documents.

Agreement - The written contract between the OWNER and the CONTRACTOR covering the WORK to be performed; other documents are attached to the Agreement and made a part thereof as provided therein.

Application for Payment - The form furnished by the ENGINEER which is to be used by the CONTRACTOR to request progress or final payment and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

Asbestos - Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

Bid - The offer or proposal of the Bidder submitted on the prescribed form setting forth the price or prices for the WORK.

Bonds - Bid, Performance, and Payment Bonds and other instruments which protect against loss due to inability or refusal of the CONTRACTOR to perform its contract.

CBJ Project Manager - The authorized representative of the City and Borough of Juneau Engineering Department, as OWNER, who is responsible for administration of the contract.

Change Order - A document recommended by the ENGINEER, which is signed by the CONTRACTOR and the OWNER and authorizes an addition, deletion, or revision in the WORK, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

Contract Documents - The Table of Contents, Notice Inviting Bids, Instructions to Bidders, Bid Forms (including the Bid, Bid Schedule(s), Information Required of Bidder, Bid Bond, and all required certificates and affidavits), Agreement, Performance Bond, Payment Bond, General Conditions, Supplementary General Conditions, Technical Specifications, Drawings, Permits, and all Addenda, and Change Orders executed pursuant to the provisions of the Contract Documents.

Contract Price - The total monies payable by the OWNER to the CONTRACTOR under the terms and conditions of the Contract Documents.

Contract Time - The number of successive calendar Days stated in the Contract Documents for the completion of the WORK.

CONTRACTOR - The individual, partnership, corporation, joint-venture or other legal entity with whom the OWNER has executed the Agreement.

SECTION 00700 - GENERAL CONDITIONS

Day - A calendar day of 24 hours measured from midnight to the next midnight.

Defective WORK - WORK that is unsatisfactory, faulty, or deficient; or that does not conform to the Contract Documents; or that does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents; or WORK that has been damaged prior to the ENGINEER's recommendation of final payment.

Drawings - The Drawings, plans, maps, profiles, diagrams, and other graphic representations which indicate the character, location, nature, extent, and scope of the WORK and which have been prepared by the ENGINEER and are referred to in the Contract Documents. Shop Drawings are not within the meaning of this paragraph.

Effective Date of the Agreement - The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

Engineer of Record - The individual, partnership, corporation, joint-venture or other legal entity named as such in the Contract Documents.

ENGINEER - The ENGINEER is the firm or person(s) selected by the City and Borough of Juneau (CBJ) to perform the duties of project inspection and management. CBJ will inform the CONTRACTOR of the identity of the ENGINEER at or before the Notice to Proceed.

Field Order - A written order issued by the ENGINEER which may or may not involve a change in the WORK.

General Requirements - Division 1 of the Technical Specifications.

Hazardous Waste - The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 9603) as amended from time to time.

Holidays - The CBJ legal holidays occur on:

1. New Year's Day - January 1
2. Martin Luther King's Birthday - Third Monday in January
3. President's Day - Third Monday in February
4. Seward's Day - Last Monday in March
5. Memorial Day - Last Monday in May
6. Independence Day - July 4
7. Labor Day - First Monday in September
8. Alaska Day - October 18
9. Veteran's Day - November 11
10. Thanksgiving Day - Fourth Thursday and the following Friday in November
11. Christmas Day - December 25

If any holiday listed above falls on a Saturday, Saturday and the preceding Friday are both legal holidays. If the holiday should fall on a Sunday, Sunday and the following Monday are both legal holidays.

SECTION 00700 - GENERAL CONDITIONS

Inspector - The authorized representative of the ENGINEER assigned to make detailed inspections for conformance to the Contract Documents. Any reference to the Resident Project Representative in this document shall mean the Inspector.

Laws and Regulations; Laws or Regulations - Any and all applicable laws, rules, regulations, ordinances, codes, and/or orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.

Mechanic's Lien - A form of security, an interest in real property, which is held to secure the payment of an obligation. When referred to in these Contract Documents, "Mechanic's Lien" or "lien" means "Stop Notice".

Milestone - A principal event specified in the Contract Documents relating to an intermediate completion date of a portion of the WORK, or a period of time within which the portion of the WORK should be performed prior to Substantial Completion of all the WORK.

Notice of Award - The written notice by the OWNER to the apparent successful bidder stating that the apparent successful bidder has complied with all conditions for award of the contract.

Notice of Completion - A form signed by the ENGINEER and the CONTRACTOR recommending to the OWNER that the WORK is Substantially Complete and fixing the date of Substantial Completion. After acceptance of the WORK by the OWNER's governing body, the form is signed by the OWNER and filed with the County Recorder. This filing starts the 30-day lien filing period on the WORK.

Notice to Proceed - The written notice issued by the OWNER to the CONTRACTOR authorizing the CONTRACTOR to proceed with the WORK and establishing the date of commencement of the Contract Time.

Notice of Intent to Award - The written notice by the OWNER to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the requirements listed therein, within the time specified, the OWNER will enter into an Agreement.

OWNER - The City and Borough of Juneau (CBJ), acting through its legally designated officials, officers, or employees.

Partial Utilization - Use by the OWNER or a substantially completed part of the WORK for the purpose for which it is intended prior to Substantial Completion of all the WORK.

PCB's - Polychlorinated biphenyls.

PERMITTEE – See definition for CONTRACTOR.

Petroleum - Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.

Project - The total construction of which the WORK to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

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Radioactive Material - Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

Shop Drawings - All Drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for the CONTRACTOR and submitted by the CONTRACTOR, to the ENGINEER, to illustrate some portion of WORK.

Specifications - Same definition as "Technical Specifications" hereinafter.

Stop Notice - A legal remedy for Subcontractors and suppliers who contribute to public works, but who are not paid for their WORK, which secures payment from construction funds possessed by the OWNER. For public property, the Stop Notice remedy is designed to substitute for mechanic's lien rights.

Sub-Consultant - The individual, partnership, corporation, joint-venture or other legal entity having a direct contract with ENGINEER, or with any of its Consultants to furnish services with respect to the Project.

Subcontractor - An individual, partnership, corporation, joint-venture or other legal entity having a direct contract with the CONTRACTOR, or with any of its Subcontractors, for the performance of a part of the WORK at the site.

Substantial Completion - Refers to when the WORK has progressed to the point where, in the opinion of the ENGINEER as evidenced by Notice of Completion as applicable, it is sufficiently complete, in accordance with the Contract Documents, so that the WORK can be utilized for the purposes for which it is intended; or if no such notice is issued, when final payment is due in accordance with Paragraph 14.8. The terms "substantially complete" and "substantially completed" as applied to any WORK refer to substantial completion thereof.

Supplementary General Conditions (SGC) - The part of the Contract Documents which make additions, deletions, or revisions to these General Conditions.

Supplier - A manufacturer, fabricator, supplier, distributor, materialman, or vendor.

Technical Specifications - Divisions 1 through 16 of the Contract Documents consisting of the General Requirements and written technical descriptions of products and execution of the WORK.

Underground Utilities - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: water, sewage and drainage removal, electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, traffic, or other control systems.

WORK, Work - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. WORK is the result of performing, or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

SECTION 00700 - GENERAL CONDITIONS

ARTICLE 2 PRELIMINARY MATTERS

- 2.1 DELIVERY OF BONDS/INSURANCE CERTIFICATES. When the CONTRACTOR delivers the signed Agreements to the OWNER, the CONTRACTOR shall also deliver to the OWNER such Bonds and Insurance Policies and Certificates as the CONTRACTOR may be required to furnish in accordance with the Contract Documents.
- 2.2 COPIES OF DOCUMENTS. The OWNER shall furnish to the CONTRACTOR the required number of copies of the Contract Documents specified in the Supplementary General Conditions.
- 2.3 COMMENCEMENT OF CONTRACT TIME; NOTICE TO PROCEED. The Contract Time will start to run on the commencement date stated in the Notice to Proceed.
- 2.4 STARTING THE WORK
- A. The CONTRACTOR shall begin to perform the WORK within 10 days after the commencement date stated in the Notice to Proceed, but no WORK shall be done at the site prior to said commencement date.
 - B. Before undertaking each part of the WORK, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. The CONTRACTOR shall promptly report in writing to the ENGINEER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the ENGINEER before proceeding with any WORK affected thereby.
 - C. The CONTRACTOR shall submit to the ENGINEER for review those documents called for under Section 01300 - CONTRACTOR Submittals in the General Requirements.
- 2.5 PRE-CONSTRUCTION CONFERENCE. The CONTRACTOR is required to attend a Pre-Construction Conference. This conference will be attended by the ENGINEER and others as appropriate in order to discuss the WORK in accordance with the applicable procedures specified in the General Requirements, Section 01010 - Summary of WORK in the General Requirements.
- 2.6 FINALIZING CONTRACTOR SUBMITTALS. At least 7 days before submittal of the first Application for Payment a conference attended by the CONTRACTOR, the ENGINEER and others as appropriate will be held to finalize the initial CONTRACTOR submittals in accordance with the General Requirements. As a minimum the CONTRACTOR's representatives should include the project manager and schedule expert. The CONTRACTOR should plan on this meeting taking no less than 8 hours. If the submittals are not finalized at the end of the meeting, additional meetings will be held so that the submittals can be finalized prior to the submittal of the first application for payment. No application for payment will be processed until CONTRACTOR submittals are finalized.

SECTION 00700 - GENERAL CONDITIONS

ARTICLE 3 CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.1 INTENT

- A. The Contract Documents comprise the entire Agreement between the OWNER and the CONTRACTOR concerning the WORK. The Contract Documents shall be construed as a whole in accordance with Alaska Law.
- B. It is the intent of the Contract Documents to describe the WORK, functionally complete, to be constructed in accordance with the Contract Documents. Any work, materials, or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result shall be supplied whether or not specifically called for. When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe work, materials, or equipment such words or phrases shall be interpreted in accordance with that meaning, unless a definition has been provided in Article 1 of the General Conditions. Reference to standard specifications, manuals, or codes of any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual, or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the OWNER, the CONTRACTOR, or the ENGINEER or any of their consultants, agents, or employees from those set forth in the Contract Documents.
- C. If, during the performance of the WORK, CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the WORK or of any such standard, specification, manual or code or of any instruction of any Supplier referred to in paragraph 6.5, the CONTRACTOR shall report it to the ENGINEER in writing at once, and the CONTRACTOR shall not proceed with the WORK affected thereby (except in an emergency as authorized by the ENGINEER) until a clarification field order, or Change Order to the Contract Documents has been issued.

3.2 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS

- A. In resolving conflicts resulting from, errors, or discrepancies in any of the Contract Documents, the order of precedence shall be as follows:
 - 1. Permits from other agencies as may be required by law, excepting the definition of "PERMITEE" in these permits.
 - 2. Field Orders
 - 3. Change Orders
 - 4. ENGINEER's written interpretations and clarifications.
 - 5. Agreement
 - 6. Addenda
 - 7. CONTRACTOR's Bid (Bid Form)
 - 8. Supplementary General Conditions
 - 9. Notice Inviting Bids

SECTION 00700 - GENERAL CONDITIONS

10. Instructions to Bidders
11. General Conditions
12. Technical Specifications
13. Drawings

B. With reference to the Drawings the order of precedence is as follows:

1. Figures govern over scaled dimensions
2. Detail Drawings govern over general Drawings
3. Addenda/ Change Order drawings govern over Contract Drawings
4. Contract Drawings govern over standard drawings

3.3 AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS. The Contract Documents may be amended to provide for additions, deletions, and revisions in the WORK or to modify the terms and conditions thereof by a Change Order (pursuant to Article 10 CHANGES IN THE WORK).

3.4 REUSE OF DOCUMENTS. Neither the CONTRACTOR, nor any Subcontractor or Supplier, nor any other person or organization performing any of the WORK under a contract with the OWNER shall have or acquire any title to or ownership rights in any of the Drawings, Technical Specifications, or other documents used on the WORK, and they shall not reuse any of them on the extensions of the Project or any other project without written consent of the OWNER.

ARTICLE 4 AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; REFERENCE POINTS

4.1 AVAILABILITY OF LANDS. The OWNER shall furnish, as indicated in the Contract Documents, the lands upon which the WORK is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of the CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the OWNER, unless otherwise provided in the Contract Documents. Nothing contained in the Contract Documents shall be interpreted as giving the CONTRACTOR exclusive occupancy of the lands or rights-of-way provided. The CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment; provided, that the CONTRACTOR shall not enter upon nor use any property not under the control of the OWNER until a written temporary construction easement, lease or other appropriate agreement has been executed by the CONTRACTOR and the property owner, and a copy of said agreement furnished to the ENGINEER prior to said use; and, neither the OWNER nor the ENGINEER shall be liable for any claims or damages resulting from the CONTRACTOR's unauthorized trespass or use of any such properties.

4.2 PHYSICAL CONDITIONS - SUBSURFACE AND EXISTING STRUCTURES

A. Explorations and Reports. Reference is made to SGC 4.2 Physical Conditions of the Supplementary General Conditions for identification of those reports of explorations and tests of sub-surface conditions at the site that have been utilized by the ENGINEER in the preparation of the Contract Documents. The CONTRACTOR may rely upon the accuracy of the technical data contained in such reports, however, reports are not to be considered complete or comprehensive and nontechnical data, interpretations, and opinions contained in such reports are not to be relied on by the CONTRACTOR. The CONTRACTOR is

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responsible for any further explorations or tests that may be necessary and any interpretation, interpolation, or extrapolation that it makes of any information shown in such reports.

- B. Existing Structures. Reference is made to SGC 4.2 Physical Conditions of the Supplementary General Conditions for identification of those drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Utilities referred to in Paragraph 4.4 herein) which are at or contiguous to the site that have been utilized by the ENGINEER in the preparation of the Contract Documents. The CONTRACTOR may rely upon the accuracy of the technical data contained in such drawings, however, nontechnical data, interpretations, and opinions contained in such drawings are not to be relied on by the CONTRACTOR. The CONTRACTOR is also responsible for any interpretation, interpolation, or extrapolation that it makes of any information shown in such drawings.

4.3 DIFFERING SITE CONDITIONS

- A. The CONTRACTOR shall promptly upon discovery (but in no event later than 14 days thereafter) and before the following conditions are disturbed, notify the ENGINEER, in writing of any:
 - 1. Material that the CONTRACTOR believes may be material that is hazardous waste, as defined in Article 1 of these General Conditions, or asbestos, PCB's, petroleum or any other substance or material posing a threat to human or to the environment.
 - 2. Subsurface or latent physical conditions at the site differing from those indicated.
 - 3. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the contract.
- B. The OWNER shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the CONTRACTOR's cost of, or the time required for, performance of any part of the WORK shall issue a Change Order under the procedures described in the contract.
- C. In the event that a dispute arises between the OWNER and the CONTRACTOR whether the conditions materially differ, or involved hazardous waste or other materials listed above, or cause a decrease or increase in the CONTRACTOR's cost of, or time required for, performance of any part of the WORK, the CONTRACTOR shall not be excused from any scheduled completion date provided for by the contract, but shall proceed with all WORK to be performed under the contract. The CONTRACTOR shall retain any and all rights provided either by contract or by Law which pertain to the resolution of disputes and protests between the contracting parties.

4.4 PHYSICAL CONDITIONS - UNDERGROUND UTILITIES

- A. Indicated. The information and data indicated in the Contract Documents with respect to existing Underground Utilities at or contiguous to the site are based on information and data furnished to the OWNER or the ENGINEER by the owners of such Underground Utilities or by others. Unless it is expressly provided in the Supplementary General Conditions and/or Section 01530 - Protection and Restoration of Existing Facilities of the General Requirements, the OWNER and the ENGINEER shall not be responsible for the accuracy or

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completeness of any such information or data, and the CONTRACTOR shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Utilities indicated in the Contract Documents, for coordination of the WORK with the owners of such Underground Utilities during construction, for the safety and protection thereof and repairing any damage thereto resulting from the WORK, the cost of which will be considered as having been included in the Contract Price.

- B. Not Indicated. If an Underground Utility is uncovered or revealed at or contiguous to the site which was not indicated in the Contract Documents and which the CONTRACTOR could not reasonably have been expected to be aware of, the CONTRACTOR shall identify the owner of such Underground Utility and give written notice thereof to that owner and shall notify the ENGINEER in accordance with the requirements of the Supplementary General Conditions and Section 01530 - Protection and Restoration of Existing Facilities of the General Requirements.

4.5 REFERENCE POINTS

- A. The ENGINEER will provide one bench mark, near or on the site of the WORK, and will provide two points near or on the site to establish a base line for use by the CONTRACTOR for alignment control. Unless otherwise specified in the General Requirements, the CONTRACTOR shall furnish all other lines, grades, and bench marks required for proper execution of the WORK.
- B. The CONTRACTOR shall preserve all bench marks, stakes, and other survey marks, and in case of their removal or destruction by its own employees or by its Subcontractor's employees, the CONTRACTOR shall be responsible for the accurate replacement of such reference points by personnel qualified under the Alaska Statute governing the licensing of Architects, Engineers, and Land Surveyors.

4.6 USE OF THE CBJ/STATE LEMON CREEK GRAVEL PIT

- A. On City and Borough of Juneau (CBJ) construction projects, the CBJ may make unclassified material available to CONTRACTORs, from the CBJ/State Lemon Creek gravel pit, at a rate less than charged other customers. CONTRACTORs are not required to use material from the CBJ/State pit and the CBJ makes no guarantee as to the quantity or quality of the available material. For this Project, contact Alec Venechuk, CBJ Material Source Manager, at (907) 586-0874 for the current material rates.
- B. CONTRACTORs proposing to use gravel from the CBJ/State pit are required to be in good standing for all amounts owed to the CBJ, for previous gravel operations, prior to submitting a mining plan for approval. CONTRACTORs using the pit must comply with Allowable Use Permit USE 2008-00061. Failure to meet these requirements, if so subject, shall be sufficient reason to deny use of the CBJ/State pit as a gravel source. To determine if your company is subject to these requirements, contact the CBJ Engineering Department, Gravel Pit Management, at (907) 586-0874.
- C. CONTRACTORs deciding to use material from the CBJ/State pit shall provide an Individual Mining Plan prepared by a professional engineer registered in the State of Alaska. The Individual Mining Plan must be reviewed and approved by the CBJ, prior to commencing

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operations within the pit. CONTRACTORS shall also secure a Performance Bond to ensure compliance with contract provisions, including any Individual Mining Plan stipulations. The bond shall remain in full force and effect until a release is obtained from the CBJ.

- D. If CONTRACTOR operations for a project do not exceed 500 tons of material, the CONTRACTOR will not be required to provide an Individual Mining Plan prepared by an engineer. However, the CONTRACTOR must submit an Individual Mining Plan that is in compliance with Allowable Use Permit USE 2008-00061 for gravel extraction within the CBJ/State pit. The CONTRACTOR must contact the CBJ Engineering Department for conditions for the extraction.
- E. CONTRACTORS using the CBJ material may do primary dry separation (screening) of materials within the pit. Crushing and washing of material will not be allowed. CONTRACTORS shall account for placement of materials removed from the pit. The CBJ may require CONTRACTORS to cross-check weight tickets, submit to an audit, or participate in other measures required by the CBJ to ensure accountability. Unprocessed overburden removed from the pit will not be weighed. All other material mined will be weighed at the CBJ scale. CONTRACTORS will be responsible for loading and/or screening their own material. If asphalt pavement is removed as part of the WORK, CONTRACTORS shall dispose of the material at a to-be-specified location within the pit area, as directed by the CBJ Project Manager.
- F. The gravel pit overhead charge shall be paid to the CBJ by the CONTRACTOR within 60 days after removal of all materials from the pit and prior to requesting and/or receiving final payment. Upon completion of each excavation CONTRACTORS shall notify the CBJ, in writing, in sufficient time to perform a field-compliance examination prior to vacating the pit. Any significant deviation from the stipulations of the Individual Mining Plan identified during the field inspection shall be corrected by the CONTRACTOR prior to release of the bond. A signed release from CBJ will be required prior to releasing the CONTRACTOR's bond.
- G. If asphalt pavement is removed as part of this WORK, the CONTRACTOR shall dispose of the material at the location designated as the Asphalt Storage Facility, or as directed by the ENGINEER.
- H. The CBJ/State pit is a seasonal operation. The hours of operation are from 7:00 a.m. to 6:00 p.m., Monday through Friday, from April 1 through October 15 of the year. CONTRACTORS may obtain gravel on weekends, or during the off-season, by applying for a separate agreement with the City and Borough of Juneau Engineering Department. The CONTRACTOR will be responsible for any additional costs incurred during weekend or off-season operations at the gravel pit.
- I. All Contractors/Equipment Operators using the CBJ/State Pit shall be in compliance with Federal Mine Safety and Health Administration regulations for quarry and gravel operations.

ARTICLE 5 BONDS AND INSURANCE

5.1 PERFORMANCE, PAYMENT, AND OTHER BONDS

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- A. The CONTRACTOR shall furnish, when required, Performance and Payment Bonds on forms provided by the CBJ for the penal sums of 100% of the amount of the Bid award. The surety on each bond may be any corporation or partnership authorized to do business in the State of Alaska as an insurer under AS 21.09. These bonds shall remain in effect for 12 months after the date of final payment and until all obligations and liens under this contract have been satisfied. The CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary General Conditions. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.
- B. If the surety on any Bond furnished by the CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the WORK is located, the CONTRACTOR shall within 7 days thereafter substitute another Bond and Surety, which must be acceptable to the OWNER.
- C. All Bonds required by the Contract Documents to be purchased and maintained by CONTRACTOR shall be obtained from surety companies that are duly licensed or authorized in the State of Alaska to issue Bonds for the limits so required. Such surety companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary General Conditions. The City Engineer may, on behalf of the OWNER, notify the surety of any potential default or liability.

5.2 INSURANCE

- A. The CONTRACTOR shall purchase and maintain the insurance required under this paragraph. Such insurance shall include the specific coverages set out herein and be written for not less than the limits of liability and coverages provided in the Supplementary General Conditions, or required by law, whichever are greater. All insurance shall be maintained continuously during the life of the Agreement up to the date of Final Completion and at all times thereafter when the CONTRACTOR may be correcting, removing, or replacing Defective WORK in accordance with Paragraph 13.6, but the CONTRACTOR's liabilities under this Agreement shall not be deemed limited in any way to the insurance coverage required.
- B. All insurance required by the Contract Documents to be purchased and maintained by the CONTRACTOR shall be obtained from insurance companies that are duly licensed or authorized in the State of Alaska to issue insurance policies for the limits and coverages so required. Such insurance companies shall have a current Best's Rating of at least an "A" (Excellent) general policy holder's rating and a Class VII financial size category and shall also meet such additional requirements and qualifications as may be provided in the Supplementary General Conditions.
- C. The CONTRACTOR shall furnish the OWNER with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. All of the policies of insurance so required to be purchased and maintained (or the certificates or other

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evidence thereof) shall contain a provision or endorsement that the coverage afforded will not be cancelled, reduced in coverage, or renewal refused until at least 30 days' prior written notice has been given to the OWNER by certified mail. All such insurance required herein (except for Workers' Compensation and Employer's Liability) shall name the OWNER, its Consultants and subconsultants and their officers, directors, agents, and employees as "additional insureds" under the policies. The CONTRACTOR shall purchase and maintain the following insurance:

1. Workers' Compensation and Employer's Liability. This insurance shall protect the CONTRACTOR against all claims under applicable state workers' compensation laws. The CONTRACTOR shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a Workers' Compensation law. This policy shall include an "all states" endorsement. The CONTRACTOR shall require each Subcontractor similarly to provide Workers' Compensation Insurance for all of the latter's employees to be engaged in such WORK unless such employees are covered by the protection afforded by the CONTRACTOR's Workers' Compensation Insurance. In case any class of employees is not protected, under the Workers' Compensation Statute, the CONTRACTOR shall provide and shall cause each Subcontractor to provide adequate employer's liability insurance for the protection of such of its employees as are not otherwise protected.
2. Commercial General Liability. This insurance shall be written in comprehensive form and shall protect the CONTRACTOR against all claims arising from injuries to persons other than its employees or damage to property of the OWNER or others arising out of any act or omission of the CONTRACTOR or its agents, employees, or Subcontractors. The policy shall contain no exclusions for any operations within the scope of this contract.
3. Comprehensive Automobile Liability. This insurance shall be written in comprehensive form and shall protect the CONTRACTOR against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, and shall cover operation on or off the site of all motor vehicles licensed for highway use, whether they are owned, non-owned, or hired. Coverage for hired motor vehicles should include endorsement covering liability assumed under this Agreement.
4. Subcontractor's Commercial General Liability Insurance and Commercial Automobile Liability Insurance. The CONTRACTOR shall either require each of its Subcontractors to procure and to maintain Subcontractor's Commercial General Liability and Property Damage Insurance and Vehicle Liability Insurance of the type and in the amounts specified in the Supplementary General Conditions or insure the activities of its Subcontractors in the CONTRACTOR's own policy, in like amount.
5. Builder's Risk. This insurance shall be of the "all risks" type, shall be written in completed value form, and shall protect the CONTRACTOR, the OWNER, and the ENGINEER, against risks of damage to buildings, structures, and materials and equipment. The amount of such insurance shall be not less than the insurable value of the WORK at completion. Builder's risk insurance shall provide for losses to be payable to the CONTRACTOR and the OWNER, as their interests may appear. The policy shall contain a provision that in the event of payment for any loss under the coverage provided, the insurance company shall have no rights of recovery against the

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CONTRACTOR, the OWNER, and the ENGINEER. The Builder's Risk policy shall insure against all risks of direct physical loss or damage to property from any external cause including flood and earthquake. Allowable exclusions, if any, shall be as specified in the Supplementary General Conditions.

ARTICLE 6 CONTRACTOR'S RESPONSIBILITIES

6.1 SUPERVISION AND SUPERINTENDENCE

- A. The CONTRACTOR shall supervise, inspect, and direct the WORK competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the WORK in accordance with the Contract Documents. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incidental thereto. The CONTRACTOR shall be responsible to see that the completed WORK complies accurately with the Contract Documents.
- B. The CONTRACTOR shall designate in writing and keep on the WORK site at all times during its progress a technically qualified, English-speaking superintendent, who is an employee of the CONTRACTOR and who shall not be replaced without written notice to the OWNER and the ENGINEER. The superintendent will be the CONTRACTOR's representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR. The CONTRACTOR shall issue all its communications to the OWNER through the ENGINEER and the ENGINEER only.
- C. The CONTRACTOR's superintendent shall be present at the site of the WORK at all times while WORK is in progress. Failure to observe this requirement shall be considered suspension of the WORK by the CONTRACTOR until such time as such superintendent is again present at the site.

6.2 LABOR, MATERIALS, AND EQUIPMENT

- A. The CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the WORK and perform construction as required by the Contract Documents. The CONTRACTOR shall furnish, erect, maintain, and remove the construction plant and any temporary works as may be required. The CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the WORK or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all WORK at the site shall be performed during regular working hours, and the CONTRACTOR will not permit overtime work or the performance of work on Saturday, Sunday, or any legal holiday without the OWNER's written consent. The CONTRACTOR shall apply for this consent through the ENGINEER.
- B. Except as otherwise provided in this Paragraph, the CONTRACTOR shall receive no additional compensation for overtime work, i.e., work in excess of 8 hours in any one calendar day or 40 hours in any one calendar week, even though such overtime work may be required under emergency conditions and may be ordered by the ENGINEER in writing. Additional compensation will be paid the CONTRACTOR for overtime work only in the

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event extra work is ordered by the ENGINEER and the Change Order specifically authorizes the use of overtime work and then only to such extent as overtime wages are regularly being paid by the CONTRACTOR for overtime work of a similar nature in the same locality.

- C. All costs of inspection and testing performed during overtime work by the CONTRACTOR which is allowed solely for the convenience of the CONTRACTOR shall be borne by the CONTRACTOR. The OWNER shall have the authority to deduct the cost of all such inspection and testing from any partial payments otherwise due to the CONTRACTOR.
 - D. Unless otherwise specified in the Contract Documents, the CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up, and completion of the WORK.
 - E. All materials and equipment to be incorporated into the WORK shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of the OWNER. If required by the ENGINEER, the CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable Supplier except as otherwise provided in the Contract Documents; but no provisions of any such instructions will be effective to assign to the ENGINEER, or any of the ENGINEER consultants, agents, or employees, any duty or authority to supervise or direct the furnishing or performance of the WORK or any duty or authority to undertake responsibility contrary to the provisions of Paragraphs 9.9C and 9.9D.
 - F. The CONTRACTOR shall at all times employ sufficient labor and equipment for prosecuting the several classes of WORK to full completion in the manner and time set forth in and required by these specifications. All workers shall have sufficient skill and experience to perform properly the WORK assigned to them. Workers engaged in special WORK, or skilled WORK, shall have sufficient experience in such WORK and in the operation of the equipment required to perform all WORK, properly and satisfactorily.
 - G. Any person employed by the CONTRACTOR or by any Subcontractor who, in the opinion of the ENGINEER, does not perform the WORK in a proper and skillful manner, or is intemperate or disorderly shall, at the written request of the ENGINEER, be removed forthwith by the CONTRACTOR or Subcontractor employing such person, and shall not be employed again in any portion of the WORK without the approval of the ENGINEER. Should the CONTRACTOR fail to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for the proper prosecution of the WORK, the ENGINEER may suspend the WORK by written notice until such orders are complied with.
- 6.3 ADJUSTING PROGRESS SCHEDULE. The CONTRACTOR shall submit monthly updates of the progress schedule to the ENGINEER for acceptance in accordance with the provisions in Section 01300 - CONTRACTOR Submittals in the General Requirements.

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- 6.4 SUBSTITUTES OR "OR-EQUAL" ITEMS. The CONTRACTOR shall submit proposed substitutes or "or-equal" items in accordance with the provisions in Section 01300 - CONTRACTOR Submittals in the General Requirements.
- 6.5 CONCERNING SUBCONTRACTORS, SUPPLIERS, AND OTHERS.
- A. The CONTRACTOR shall be responsible to the OWNER and the ENGINEER for the acts and omissions of its Subcontractors and their employees to the same extent as CONTRACTOR is responsible for the acts and omissions of its own employees. Nothing contained in this Paragraph shall create any contractual relationship between any Subcontractor and the OWNER or the ENGINEER nor relieve the CONTRACTOR of any liability or obligation under the prime contract.
- B. The CONTRACTOR shall perform not less than 40% of the WORK with its own forces (i.e., without subcontracting). The 40% requirement shall be understood to mean that the CONTRACTOR shall perform, with its own organization, WORK amounting to at least 40% of the awarded contract amount. The 40% requirement will be calculated based upon the total of the subcontract amounts submitted for contract award, and any other information requested by the OWNER from the apparent low bidder.
- 6.6 PERMITS
- A. Unless otherwise provided in the Supplementary General Conditions, the CONTRACTOR shall obtain and pay for all construction permits and licenses from the agencies having jurisdiction, including the furnishing of insurance and bonds if required by such agencies. The enforcement of such requirements under this contract shall not be made the basis for claims for additional compensation. The OWNER shall assist the CONTRACTOR, when necessary, in obtaining such permits and licenses. The CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the WORK, which are applicable at the time of opening of Bids. The CONTRACTOR shall pay all charges of utility owners for connections to the WORK.
- B. These Contract Documents may require that the WORK be performed within the conditions and/or requirements of local, state and/or federal permits. These permits may be bound within the Contract Documents, included within the Contract Documents by reference, or included as part of the WORK, as designated in this Section. The CONTRACTOR is responsible for completing the WORK required for compliance with all permit requirements; this WORK is incidental to other items in the Contract Documents. Any reference to the PERMITTEE in the permits shall mean the CONTRACTOR. If any permits were acquired by the OWNER, this action was done to expedite the start of construction. If the CONTRACTOR does not complete the WORK within the specified permit window, the CONTRACTOR shall be responsible for the permit extension, and for completing any additional requirements placed upon the permit.
- C. The OWNER shall apply for, and obtain, the necessary building permit for this Project, however, the CONTRACTOR is responsible for scheduling and coordinating all necessary inspections. The CBJ Inspection number is 586-1703. All other provisions of this Section remain in effect.

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- 6.7 PATENT FEES AND ROYALTIES. The CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the WORK or the incorporation in the WORK of any invention, design, process, product, software or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the WORK and if to the actual knowledge of the OWNER or the ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the OWNER in the Contract Documents. The CONTRACTOR shall indemnify, defend and hold harmless the OWNER and the ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses, and expenses (including attorneys' fees and court costs) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the WORK or resulting from the incorporation in the WORK of any invention, design, process, product, or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.
- 6.8 LAWS AND REGULATIONS. The CONTRACTOR shall observe and comply with all federal, state, and local laws, ordinances, codes, orders, and regulations which in any manner affect those engaged or employed on the WORK, the materials used in the WORK, or the conduct of the WORK. If any discrepancy or inconsistency should be discovered in this contract in relation to any such law, ordinance, code, order, or regulation, the CONTRACTOR shall report the same in writing to the ENGINEER. The CONTRACTOR shall indemnify, defend, and hold harmless the OWNER, the ENGINEER, and their officers, agents, and employees against all claims or liability arising from violation of any such law, ordinance, code, order, or regulation, whether by CONTRACTOR or by its employees, Subcontractors, or third parties. Any particular law or regulation specified or referred to elsewhere in the Contract Documents shall not in any way limit the obligation of the CONTRACTOR to comply with all other provisions of federal, state, and local laws and regulations. The OWNER may, per AS 36.30, audit the CONTRACTOR's or Subcontractor(s) records that are related to the cost or pricing data for this contract, all related Change Orders, and/or contract modifications.
- 6.9 TAXES. The CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by the CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the WORK.
- 6.10 USE OF PREMISES. The CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to (1) the Project site, (2) the land and areas identified in and permitted by the Contract Documents, and (3) the other land and areas permitted by Laws and Regulations, rights-of-way, permits, leases and easements. The CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the WORK. Should any claim be made against the OWNER or the ENGINEER by any such owner or occupant because of the performance of the WORK, the CONTRACTOR shall promptly attempt to settle with such other party by agreement or otherwise resolve the claim through litigation. The CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify, defend, and hold the OWNER and the ENGINEER harmless from and against all claims, damages, losses, and expenses (including, but not limited to, fees of engineers attorneys, and other professionals and court costs) arising directly, indirectly, or consequentially out of any action, legal or equitable, brought by any such owner or occupant against the OWNER, the ENGINEER, their Consultants, Sub-consultants, and the officers,

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directors, employees and agents of each and any of them to the extent caused by or based upon the CONTRACTOR's performance of the WORK.

6.11 SAFETY AND PROTECTION

- A. The CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
1. all employees on the WORK and other persons and organizations who may be affected thereby;
 2. all the WORK and materials and equipment to be incorporated therein, whether in storage on or off the site; and
 3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
- B. The CONTRACTOR shall comply with all applicable Laws and Regulations whether referred to herein or not) of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss and shall erect and maintain all necessary safeguards for such safety and protection. The CONTRACTOR shall notify owners of adjacent property and utilities when prosecution of the WORK may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. The CONTRACTOR shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and program.
- D. Materials that contain hazardous substances or mixtures may be required on the WORK. A Material Safety Data Sheet shall be requested by the CONTRACTOR from the manufacturer of any hazardous product used.
- E. Material usage shall be accomplished with strict adherence to all safety requirements and all manufacturer's warnings and application instructions listed on the Material Safety Data Sheet and on the product container label.
- F. The CONTRACTOR shall be responsible for coordinating communications on any exchange of Material Safety Data Sheets or other hazardous material information that is required to be made available to, or exchanged between, or among, employers at the site in accordance with Laws or Regulations.
- G. The CONTRACTOR shall notify the ENGINEER if it considers a specified product or its intended usage to be unsafe. This notification must be given to the ENGINEER prior to the product being ordered, or if provided by some other party, prior to the product being incorporated in the WORK.

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6.12 SHOP DRAWINGS AND SAMPLES

- A. After checking and verifying all field measurements and after complying with applicable procedures specified in the General Requirements, the CONTRACTOR shall submit to the ENGINEER for review, all Shop Drawings in accordance with Section 01300 - CONTRACTOR Submittals in the General Requirements.
- B. The CONTRACTOR shall also submit to the ENGINEER for review all samples in accordance with Section 01300 - CONTRACTOR Submittals in the General Requirements.
- C. Before submittal of each shop drawing or sample, the CONTRACTOR shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar data with respect thereto and reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples and with the requirements of the WORK and the Contract Documents.

6.13 CONTINUING THE WORK. The CONTRACTOR shall carry on the WORK and adhere to the progress schedule during all disputes or disagreements with the OWNER. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the CONTRACTOR and the OWNER may otherwise agree in writing.

6.14 INDEMNIFICATION

- A. To the fullest extent permitted by Laws and Regulations, the CONTRACTOR shall indemnify, defend, and hold harmless the OWNER, the ENGINEER, their Consultants, Sub-consultants and the officers, directors, employees, and agents of each and any of them, against and from all claims and liability arising under, by reason of or incidentally to the contract or any performance of the WORK, but not from the sole negligence or willful misconduct of the OWNER, and the ENGINEER. Such indemnification by the CONTRACTOR shall include but not be limited to the following:
 - 1. Liability or claims resulting directly or indirectly from the negligence or carelessness of the CONTRACTOR, its employees, or agents in the performance of the WORK, or in guarding or maintaining the same, or from any improper materials, implements, or appliances used in its construction, or by or on account of any act or omission of the CONTRACTOR, its employees, agents, or third parties;
 - 2. Liability or claims arising directly or indirectly from bodily injury, occupational sickness or disease, or death of the CONTRACTOR's or Subcontractor's own employees engaged in the WORK resulting in actions brought by or on behalf of such employees against the OWNER, and the ENGINEER;
 - 3. Liability or claims arising directly or indirectly from or based on the violation of any law, ordinance, regulation, order, or decree, whether by the CONTRACTOR, its employees, or agents;
 - 4. Liability or claims arising directly or indirectly from the use or manufacture by the CONTRACTOR, its employees, or agents in the performance of this contract of any copyrighted or non-copyrighted composition, secret process, patented or non-patented invention, computer software, article, or appliance, unless otherwise specifically stipulated in this contract.

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5. Liability or claims arising directly or indirectly from the breach of any warranties, whether express or implied, made to the OWNER or any other parties by the CONTRACTOR, its employees, or agents;
 6. Liabilities or claims arising directly or indirectly from the willful or criminal misconduct of the CONTRACTOR, its employees, or agents; and,
 7. Liabilities or claims arising directly or indirectly from any breach of the obligations assumed herein by the CONTRACTOR.
- B. The CONTRACTOR shall reimburse the ENGINEER and the OWNER for all costs and expenses, (including but not limited to fees and charges of engineers, attorneys, and other professionals and court costs including all costs of appeals) incurred by said OWNER, and the ENGINEER in enforcing the provisions of this Paragraph 6.14.
- C. The indemnification obligation under this Paragraph 6.14 shall not be limited in any way by any limitation of the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR or any such Subcontractor or other person or organization under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- 6.15 CONTRACTOR'S DAILY REPORTS. The CONTRACTOR shall complete a daily report indicating total manpower for each construction trade, major equipment on site, each Subcontractor's manpower, weather conditions, etc., involved in the performance of the WORK. The daily report shall be completed on forms provided by the ENGINEER and shall be submitted to the ENGINEER at the conclusion of each workday. The report should comment on the daily progress and status of the WORK within each major component of the WORK. These components will be decided by the ENGINEER. CONTRACTOR shall record the name, affiliation, time of arrival and departure, and reason for visit for all visitors to the location of the WORK.
- 6.16 ASSIGNMENT OF CONTRACT. The CONTRACTOR shall not assign, sublet, sell, transfer, or otherwise dispose of the contract or any portion thereof, or its right, title, or interest therein, or obligations thereunder, without the written consent of the OWNER except as imposed by law. If the CONTRACTOR violates this provision, the contract may be terminated at the option of the OWNER. In such event, the OWNER shall be relieved of all liability and obligations to the CONTRACTOR and to its assignee or transferee, growing out of such termination.
- 6.17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES. It is understood that any turn-on or turn-off, line locates and any other work or assistance necessary by the CBJ Water Utilities Division, will be at the CONTRACTOR's expense unless otherwise stated in the bid documents. All cost must be agreed to prior to any related actions, and will be considered incidental to the project cost. Billing to the CONTRACTOR will be direct from the CBJ Water Utilities Division.
- 6.18 OPERATING WATER SYSTEM VALVES
- A. The CONTRACTOR shall submit a written request, to the ENGINEER, for approval to operate any valve on any in-service section of the CBJ water system. The request must be submitted at least 24-hours prior to operating any valves. The CBJ Water Utilities Division reserves the right to approve or deny the request. The request shall specifically identify each valve to be operated, the time of operation, and the operation to be performed. The

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CONTRACTOR shall obtain the written approval of the ENGINEER for any scheduled operation before operating any valve.

- B. The CONTRACTOR shall be responsible for all damages, both direct and consequential, to the City or any other party, caused by unauthorized operation of any valve of the CBJ water system.
- 6.19 CONTRACTOR'S WORK SCHEDULE LIMITATIONS. Construction of Buildings and Projects. It is unlawful to operate any pile driver, power shovel, pneumatic hammer, derrick, power hoist, or similar heavy construction equipment before 7:00 a.m. or after 10:00 p.m., Monday through Friday, or before 9:00 a.m. or after 10:00 p.m., Saturday and Sunday, unless a permit shall first be obtained from the City and Borough Building Official. Such permit shall be issued by the Building Official only upon a determination that such operation during hours not otherwise permitted hereunder is necessary and will not result in unreasonable disturbance to surrounding residents.

ARTICLE 7 OTHER WORK

7.1 RELATED WORK AT SITE

- A. The OWNER may perform other work related to the Project at the site by the OWNER's own forces, have other work performed by utility owners, or let other direct contracts therefor which may contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the Contract Documents, written notice thereof will be given to the CONTRACTOR prior to starting any such other work.
- B. The CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (or the OWNER, if the OWNER is performing the additional work with the OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such work, and shall properly connect and coordinate the WORK with theirs. The CONTRACTOR shall do all cutting, fitting, and patching of the WORK that may be required to make its several parts come together properly and integrate with such other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of the ENGINEER and the others whose work will be affected.
- C. If the proper execution or results of any part of the CONTRACTOR's work depends upon the work of any such other contractor or utility owner (or OWNER), the CONTRACTOR shall inspect and report to the ENGINEER in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for such proper execution and results. The CONTRACTOR's failure to report such delays, defects, or deficiencies will constitute an acceptance of the other work as fit and proper for integration with the CONTRACTOR's work except for latent or nonapparent defects and deficiencies in the other work.

- 7.2 COORDINATION. If the OWNER contracts with others for the performance of other work on the Project at the site, the person or organization who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified in the Supplementary General Conditions, and the specific matters to be covered by such authority and

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responsibility will be itemized and the extent of such authority and responsibilities will be provided in the Supplementary General Conditions.

ARTICLE 8 OWNER'S RESPONSIBILITIES

8.1 COMMUNICATIONS

- A. The OWNER shall issue all its communications to the CONTRACTOR through the ENGINEER.
- B. The CONTRACTOR shall issue all its communications to the OWNER through the ENGINEER.

8.2 PAYMENTS. The OWNER shall make payments to the CONTRACTOR as provided in Paragraphs 14.5, 14.8, 14.9 and 14.10.

8.3 LANDS, EASEMENTS, AND SURVEYS. The OWNER's duties in respect of providing lands and easements and providing surveys to establish reference points are set forth in Paragraphs 4.1 and 4.5.

8.4 CHANGE ORDERS. The OWNER shall execute Change Orders as indicated in Paragraph 10.1F.

8.5 INSPECTIONS AND TESTS. The OWNER's responsibility in respect of inspections, tests, and approvals is set forth in Paragraph 13.3.

8.6 SUSPENSION OF WORK. In connection with the OWNER's right to stop WORK or suspend WORK, see Paragraphs 13.4 and 15.1.

8.7 TERMINATION OF AGREEMENT. Paragraphs 15.2 and 15.3 deal with the OWNER's right to terminate services of the CONTRACTOR.

ARTICLE 9 ENGINEER'S STATUS DURING CONSTRUCTION

9.1 OWNER'S REPRESENTATIVE. The ENGINEER will be the OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of the ENGINEER as the OWNER's representative during construction are set forth in the Contract Documents.

9.2 VISITS TO SITE. The ENGINEER will make visits to the site during construction to observe the progress and quality of the WORK and to determine, in general, if the WORK is proceeding in accordance with the Contract Documents. Exhaustive or continuous on-site inspections to check the quality or quantity of the WORK will not be required of the ENGINEER. The ENGINEER will not, during such visits, or as a result of such observations of the CONTRACTOR's WORK in progress, supervise, direct, or have control over the CONTRACTOR's WORK.

9.3 PROJECT REPRESENTATION. The ENGINEER may furnish an Inspector to assist in observing the performance of the WORK. The duties, responsibilities, and limitations of authority are as follows:

- A. Duties, Responsibilities and Limitations of Authority of Inspector

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General. The Inspector, who is the ENGINEER's Agent, will act as directed by and under the supervision of the ENGINEER and will confer with the ENGINEER regarding its actions. The Inspector's dealings in matters pertaining to the on-site WORK shall, in general, be only with the ENGINEER and the CONTRACTOR, and dealings with Subcontractors shall only be through or with the full knowledge of the CONTRACTOR. Written communication with the OWNER will be only through or as directed by the ENGINEER.

Duties and Responsibilities. The Inspector may:

1. Review the progress schedule, list of Shop Drawing submittals and schedule of values prepared by the CONTRACTOR and consult with the ENGINEER concerning their acceptability.
2. Attend pre-construction conferences. Arrange a schedule of progress meetings and other job conferences as required in consultation with the ENGINEER and notify those expected to attend in advance. Attend meetings and maintain and circulate copies of minutes thereof.
3. Serve as the ENGINEER's liaison with the CONTRACTOR, working principally through the CONTRACTOR's superintendent and assist said superintendent in understanding the intent of the Contract Documents. Assist the ENGINEER in serving as the OWNER's liaison with the CONTRACTOR when the CONTRACTOR's operations affect the OWNER's on-site operations.
4. As requested by the ENGINEER, assist in obtaining from the OWNER additional details or information, when required at the site for proper execution of the WORK.
5. Receive and record date of receipt of Shop Drawings and samples, receive samples which are furnished at the site by the CONTRACTOR and notify the ENGINEER of their availability for examination.
6. Conduct on-site observations of the WORK in progress to assist the ENGINEER in determining if the WORK is proceeding in accordance with the Contract Documents.
7. Report to the ENGINEER whenever the Inspector believes that any WORK is unsatisfactory, faulty, or defective or does not conform to the Contract Documents, or does not meet the requirements of any inspection, tests or approval required to be made or has been damaged prior to final payment; and advise the ENGINEER when the Inspector believes WORK should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection, or approval.
8. Verify that the tests, equipment, and systems startups and operating and maintenance instruction are conducted as required by the Contract Documents and in presence of the required personnel, and that the CONTRACTOR maintains adequate records thereof; observe, record and report to the ENGINEER appropriate details relative to the test procedures and start-ups.
9. Accompany visiting inspectors representing public or other agencies having jurisdiction over the WORK, record the outcome of these inspections, and report to the ENGINEER.
10. Transmit to the CONTRACTOR the ENGINEER's clarifications and interpretations of the Contract Documents.
11. Consider and evaluate the CONTRACTOR's suggestions for modifications in the Contract Documents and report them with recommendations to the ENGINEER.
12. Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and sample submittals, reproductions of original Contract Documents including all addenda, Change Orders, field orders, additional Drawings issued

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subsequent to the execution of the contract, the ENGINEER's clarifications and interpretations of the Contract Documents, progress reports, and other related documents.

13. Keep a diary or log book, recording hours on the job site, weather conditions, data relative to questions of extras or deductions, list all project visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of performing and observing test procedures. Send copies to the ENGINEER.
14. Record names, addresses, and telephone numbers of the CONTRACTOR, Subcontractors, and major suppliers of materials and equipment.
15. Furnish the ENGINEER with periodic reports as required of progress of the WORK and the CONTRACTOR's compliance with the accepted progress schedule and schedule of CONTRACTOR submittals.
16. Consult with the ENGINEER in advance of scheduled major tests, inspections, or start of important phases of the WORK.
17. Report immediately to the ENGINEER upon the occurrence of any accident.
18. Review applications for payment with the CONTRACTOR for compliance with the established procedure for their submittal and forward them with recommendations to the ENGINEER, noting particularly their relation to the schedule of values, WORK completed, and materials and equipment delivered at the site but not incorporated in the WORK.
19. During the course of the WORK, verify that certificates, maintenance and operation manuals, and other data required to be assembled and furnished by the CONTRACTOR are applicable to the items actually installed; and deliver this material to the ENGINEER for its review and forwarding to the OWNER prior to final acceptance of the WORK.
20. Before the ENGINEER prepares a Certificate of Substantial Completion/Notice of Completion, as applicable, review the CONTRACTOR's punch list items requiring completion or correction and add any items that CONTRACTOR has omitted.
21. Conduct final inspection in the company of the ENGINEER, the OWNER, and the CONTRACTOR, and prepare a final punch list of items to be completed or corrected.
22. Verify that all items on the punch list have been completed or corrected and make recommendations to the ENGINEER concerning acceptance.

Limitations of Authority. Except upon written instruction of the ENGINEER, the Inspector:

1. Shall not authorize any deviation from the Contract Documents or approve any substitute material or equipment.
2. Shall not exceed limitations on the ENGINEER's authority as set forth in the Contract Documents.
3. Shall not undertake any of the responsibilities of the CONTRACTOR, Subcontractors or CONTRACTOR's superintendent, or expedite the WORK.
4. Shall not advise on or issue directions relative to any aspect of the means, methods, techniques, sequences, or procedures of construction unless such is specifically called for in the Contract Documents.
5. Shall not advise on or issue directions as to safety precautions and programs in connection with the WORK.

9.4 CLARIFICATIONS AND INTERPRETATIONS. The ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract

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Documents (in the form of Drawings or otherwise) as the ENGINEER may determine necessary, which shall be consistent with, or reasonably inferred from, the overall intent of the Contract Documents.

9.5 AUTHORIZED VARIATIONS IN WORK. The ENGINEER may authorize variations in the WORK from the requirements of the Contract Documents. These may be accomplished by a Field Order and will require the CONTRACTOR to perform the WORK involved in a manner that minimizes the impact to the WORK and the contract completion date. If the CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time, the CONTRACTOR may make a claim therefor as provided in Article 11 or 12.

9.6 REJECTING DEFECTIVE WORK. The ENGINEER will have authority to reject WORK which the ENGINEER believes to be defective and will also have authority to require special inspection or testing of the WORK as provided in Paragraph 13.3G, whether or not the WORK is fabricated, installed, or completed.

9.7 CONTRACTOR SUBMITTALS, CHANGE ORDERS, AND PAYMENTS

A. In accordance with the procedures set forth in the General Requirements, the ENGINEER will review all CONTRACTOR submittals, including Shop Drawings, samples, substitutes, or "or equal" items, etc., in order to determine if the items covered by the submittals will, after installation or incorporation in the WORK, conform to the requirements of the Contract Documents and be compatible with the design concept of the completed project as a functioning whole as indicated by the Contract Documents. The ENGINEER's review will not extend to means, methods, techniques, sequences or procedures of construction or to safety precautions or programs incident thereto.

B. In connection with the ENGINEER's responsibilities as to Change Orders, see Articles 10, 11, and 12.

C. In connection with the ENGINEER's responsibilities in respect of Applications for Payment, see Article 14.

9.8 DECISIONS ON DISPUTES

A. The ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the WORK thereunder. Claims, disputes, and other matters relating to the acceptability of the WORK; the interpretation of the requirements of the Contract Documents pertaining to the performance of the WORK; and those claims under Articles 11 and 12 in respect to changes in the Contract Price or Contract Time will be referred initially to the ENGINEER in writing with a request for formal decision in accordance with this paragraph, which the ENGINEER will render in writing within 30 days of receipt of the request. Written notice of each such claim, dispute, and other matter will be delivered by the CONTRACTOR to the ENGINEER promptly (but in no event later than 30 days) after the occurrence of the event giving rise thereto. Written supporting data will be submitted to the ENGINEER within 60 days after such occurrence unless the ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim.

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- B. The rendering of a decision by the ENGINEER with respect to any such claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in Paragraph 14.12) will be a condition precedent to any exercise by the OWNER or the CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Law or Regulations in respect of any such claim, dispute, or other matter.

9.9 LIMITATION ON ENGINEER'S RESPONSIBILITIES

- A. Neither the ENGINEER's authority to act under this Article or other provisions of the Contract Documents nor any decision made by the ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of the ENGINEER to the CONTRACTOR, any Subcontractor, any Supplier, any surety for any of them, or any other person or organization performing any of the WORK.
- B. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as reviewed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review, or judgment of the ENGINEER as to the WORK, it is intended that such requirement, direction, review, or judgment will be solely to evaluate the WORK for compliance with the requirements of the Contract Documents, and conformance with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents, unless there is a specific statement indicating otherwise. The use of any such term or adjective shall not be effective to assign to the ENGINEER any duty or authority to supervise or direct the performance of the WORK or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.9C or 9.9D.
- C. The ENGINEER will not supervise, direct, control, or have authority over or be responsible for the CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of the CONTRACTOR to comply with Laws and Regulations, applicable to the performance of the WORK. The ENGINEER will not be responsible for the CONTRACTOR's failure to perform the WORK in accordance with the Contract Documents.
- D. The ENGINEER will not be responsible for the acts or omissions of the CONTRACTOR nor of any Subcontractor, supplier, or any other person or organization performing any of the WORK.

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ARTICLE 10 CHANGES IN THE WORK

10.1 GENERAL

- A. Without invalidating the Agreement and without notice to any surety, the OWNER may at any time or from time to time, order additions, deletions, or revisions in the WORK; these will be authorized by a written Field Order and/or a Change Order issued by the ENGINEER.
- B. If the CONTRACTOR believes that it is entitled to an increase or decrease in the Contract Price, or an extension or shortening in the Contract Time as the result of a Field Order, a claim may be made as provided in Articles 11 and 12.
- C. If the OWNER and CONTRACTOR agree on the value of any work, or the amount of Contract Time that should be allowed as a result of a Field Order, upon receiving written notice from the ENGINEER, the CONTRACTOR shall proceed so as to minimize the impact on and delays to the work pending the issuance of a Change Order.
- D. If the OWNER and the CONTRACTOR are unable to agree as to the extent, if any, of an increase or decrease in the Contract Price or an extension or shortening of the Contract Time that should be allowed as a result of a Field Order, the ENGINEER can direct the CONTRACTOR to proceed on the basis of Time and Materials so as to minimize the impact on and delays to WORK, and a claim may be made therefor as provided in Articles 11 and 12.
- E. The CONTRACTOR shall not be entitled to an increase in the Contract Price nor an extension of the Contract Time with respect to any work performed that is not required by the Contract Documents as amended, modified, supplemented by Change Order, except in the case of an emergency and except in the case of uncovering work as provided in Paragraph 13.3G.
- F. The OWNER and the CONTRACTOR shall execute appropriate Change Orders covering:
 - 1. changes in the WORK which are ordered by the OWNER pursuant to Paragraph 10.1A;
 - 2. changes required because of acceptance of Defective WORK under Paragraph 13.7;
 - 3. changes in the Contract Price or Contract Time which are agreed to by the parties; or
 - 4. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by the ENGINEER pursuant to Paragraph 9.8.
- G. If notice of any change is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be the CONTRACTOR's responsibility, and the amount of each applicable Bond shall be adjusted accordingly.

10.2 ALLOWABLE QUANTITY VARIATIONS

- A. In the event of an increase or decrease in Bid item quantity of a unit price contract, the total amount of WORK actually done or materials or equipment furnished shall be paid for according to the unit price established for such WORK under the Contract Documents, wherever such unit price has been established; provided, that an adjustment in the Contract Price may be made for changes which result in an increase or decrease in excess of 25% of

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the estimated quantity of any major item of the WORK. Major Item is defined as any bid item amount that is ten percent (10%) or more of the total contract amount.

- B. In the event a part of the WORK is to be entirely eliminated and no lump sum or unit price is named in the Contract Documents to cover such eliminated work, the price of the eliminated work shall be agreed upon in writing by the OWNER and the CONTRACTOR. If the OWNER and the CONTRACTOR fail to agree upon the price of the eliminated work, said price shall be determined in accordance with the provisions of Article 11.

ARTICLE 11 CHANGE OF CONTRACT PRICE

11.1 GENERAL

- A. The Contract Price constitutes the total compensation payable to the CONTRACTOR for performing the WORK. All duties, responsibilities, and obligations assigned to or undertaken by the CONTRACTOR to complete the WORK shall be at its expense without change in the Contract Price.
- B. The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered by the CONTRACTOR to the ENGINEER promptly (but in no event later than 7 days) after the start of the occurrence or the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within 14 days after such occurrence (unless the ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR's written statement that the amount claimed covers all known amounts (direct, indirect, and consequential) to which the CONTRACTOR is entitled as a result of said occurrence or event. All claims for adjustment in the Contract Price shall be determined by the ENGINEER in accordance with Paragraph 9.8A if the OWNER and the CONTRACTOR cannot otherwise agree on the amount involved. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this Paragraph 11.1B.
- C. The value of any WORK covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:
 - 1. Where the WORK involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.
 - 2. By mutual acceptance of a lump sum, which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.4.
 - 3. On the basis of the cost of WORK (determined as provided in Paragraphs 11.3) plus a CONTRACTOR's fee for overhead and profit (determined as provided in Paragraph 11.4).

- 11.2 COSTS RELATING TO WEATHER. The CONTRACTOR shall have no claims against the OWNER for damages for any injury to WORK, materials, or equipment, resulting from the action of the elements. If, however, in the opinion of the ENGINEER, the CONTRACTOR has made all reasonable efforts to protect the materials, equipment and work, the CONTRACTOR may be granted a reasonable extension of Contract Time to make proper repairs, renewals, and replacements of the work, materials, or equipment.

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11.3 COST OF WORK (BASED ON TIME AND MATERIALS)

- A. General. The term "cost of work" means the sum of all costs necessarily incurred and paid by the CONTRACTOR for labor, materials, and equipment in the proper performance of extra work. Except as otherwise may be agreed to in writing by the OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project; shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.5 EXCLUDED COSTS.
- B. Labor. The costs of labor will be the actual cost for wages prevailing for each craft or type of workers performing the extra work at the time the extra work is done, plus employer payments of payroll taxes, worker's compensation insurance, liability insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from Federal, State or local laws, as well as assessments or benefits required by lawful collective bargaining agreements. Labor costs for equipment operators and helpers shall be paid only when such costs are not included in the invoice for equipment rental. The labor costs for forepersons shall be proportioned to all of their assigned work and only that applicable to extra work shall be paid. Non-direct labor costs including superintendence shall be considered part of the mark-up set out in paragraph 11.4.
- C. Materials. The cost of materials reported shall be at invoice or lowest current price at which materials are locally available and delivered to the job in the quantities involved, plus the cost of freight, delivery and storage, subject to the following:
1. Trade discounts available to the purchaser shall be credited to the OWNER notwithstanding the fact that such discounts may not have been taken by the CONTRACTOR.
 2. For materials secured by other than a direct purchase and direct billing to the purchaser, the cost shall be deemed to be the price paid to the actual supplier as determined by the ENGINEER. Mark-up except for actual costs incurred in the handling of such materials will not be allowed.
 3. Payment for materials from sources owned wholly or in part by the purchaser shall not exceed the price paid by the purchaser for similar materials from said sources on extra work items or the current wholesale price for such materials delivered to the work site, whichever price is lower.
 4. If in the opinion of the ENGINEER the cost of material is excessive, or the CONTRACTOR does not furnish satisfactory evidence of the cost of such material, then the cost shall be deemed to be the lowest current wholesale price for the quantity concerned delivered to the work site less trade discount. The OWNER reserves the right to furnish materials for the extra work and no claim shall be allowed by the CONTRACTOR for costs and profit on such materials.
- D. Equipment. The CONTRACTOR will be paid for the use of equipment at the rental rate listed for such equipment specified in the Supplementary General Conditions. Such rental rate will be used to compute payments for equipment whether the equipment is under the CONTRACTOR's control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment shall be the rate resulting in the least total cost to the OWNER for the total period of use. If it is deemed

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necessary by the CONTRACTOR to use equipment not listed in the publication specified in the Supplementary General Conditions, an equitable rental rate for the equipment will be established by the ENGINEER. The CONTRACTOR may furnish cost data which might assist the ENGINEER in the establishment of the rental rate.

1. All equipment shall, in the opinion of the ENGINEER, be in good working condition and suitable for the purpose for which the equipment is to be used.
 2. Before construction equipment is used on the extra work, the CONTRACTOR shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the ENGINEER, in duplicate, a description of the equipment and its identifying number.
 3. Unless otherwise specified, manufacturer's ratings and manufacturer approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer.
 4. Individual pieces of equipment or tools having a replacement value of \$200 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefor.
 5. Rental time will not be allowed while equipment is inoperative due to breakdowns.
 6. Equipment Rental Rates. Unless otherwise agreed in writing, the CONTRACTOR will be paid for the use of equipment at the rental rate listed for such equipment specified in the current edition of the following reference publication: "Rental Rate Blue Book" as published by Dataquest (a company of the Dunn and Bradstreet Corporation), 1290 Ridder Park Drive, San Jose, CA 95131, telephone number (800) 227-8444.
- E. Equipment on the Work Site. The rental time to be paid for equipment on the work site shall be the time the equipment is in productive operation on the extra work being performed and, in addition, shall include the time required to move the equipment to the location of the extra work and return it to the original location or to another location requiring no more time than that required to return it to its original location; except, that moving time will not be paid if the equipment is used on other than the extra work, even though located at the site of the extra work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power, except that no payment will be made for loading and transporting costs when the equipment is used at the site of the extra work on other than the extra work. The following shall be used in computing the rental time of equipment on the work site.
1. When hourly rates are listed, any part of an hour less than 30 minutes of operation shall be considered to be 1/2-hour of operation, and any part of an hour in excess of 30 minutes will be considered one hour of operation.
 2. When daily rates are listed, any part of a day less than 4 hours operation shall be considered to be 1/2-day of operation. When owner-operated equipment is used to perform extra work to be paid for on a time and materials basis, the CONTRACTOR will be paid for the equipment and operator, as set forth in Paragraphs (3), (4), and (5), following.
 3. Payment for the equipment will be made in accordance with the provisions in Paragraph 11.3D, herein.
 4. Payment for the cost of labor and subsistence or travel allowance will be made at the rates paid by the CONTRACTOR to other workers operating similar equipment already

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on the work site, or in the absence of such labor, established by collective bargaining agreements for the type of worker and location of the extra work, whether or not the operator is actually covered by such an agreement. A labor surcharge will be added to the cost of labor described herein in accordance with the provisions of Paragraph 11.3B, herein, which surcharge shall constitute full compensation for payments imposed by state and federal laws and all other payments made to or on behalf of workers other than actual wages.

5. To the direct cost of equipment rental and labor, computed as provided herein, will be added the allowances for equipment rental and labor as provided in Paragraph 11.4, herein.
- F. Specialty Work. Specialty work is defined as that work characterized by extraordinary complexity, sophistication, or innovation or a combination of the foregoing attributes which are unique to the construction industry. The following shall apply in making estimates for payment for specialty work:
1. Any bid item of WORK to be classified as Specialty Work shall be listed as such in the Supplementary General Conditions. Specialty work shall be performed by an entity especially skilled in the work to be performed. After validation of invoices and determination of market values by the ENGINEER, invoices for specialty work based upon the current fair market value thereof may be accepted without complete itemization of labor, material, and equipment rental costs.
 2. When the CONTRACTOR is required to perform work necessitating special fabrication or machining process in a fabrication or a machine shop facility away from the job site, the charges for that portion of the work performed at the off-site facility may, by agreement, be accepted as specialty work and accordingly, the invoices for the work may be accepted without detailed itemization.
 3. All invoices for specialty work will be adjusted by deducting all trade discounts offered or available, whether the discounts were taken or not. In lieu of the allowances for overhead and profit specified in Paragraph 11.4, herein, an allowance of 5 percent will be added to invoices for specialty work.
- G. Sureties. All work performed hereunder shall be subject to all of the provisions of the Contract Documents and the CONTRACTOR's sureties shall be bound with reference thereto as under the original Agreement. Copies of all amendments to surety bonds or supplemental surety bonds shall be submitted to the OWNER for review prior to the performance of any work hereunder.

11.4 CONTRACTOR'S FEE

- A. Extra work ordered on the basis of time and materials will be paid for at the actual necessary cost as determined by the ENGINEER, plus allowances for overhead and profit. The allowance for overhead and profit shall include full compensation for superintendence, bond and insurance premiums, taxes, field office expense, extended overhead, home office overhead, and all other items of expense or cost not included in the cost of labor, materials, or equipment provided for under Paragraph 11.3. The allowance for overhead and profit will be made in accordance with the following schedule:

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Actual Overhead and Profit Allowance

Labor.....	15 percent
Materials.....	10 percent
Equipment.....	10 percent

To the sum of the costs and mark-ups provided for in this Article, one percent shall be added as compensation for bonding.

- B. It is understood that labor, materials, and equipment may be furnished by the CONTRACTOR or by the Subcontractor on behalf of the CONTRACTOR. When all or any part of the extra work is performed by a Subcontractor, the allowance specified herein shall be applied to the labor, materials, and equipment costs of the Subcontractor, to which the CONTRACTOR may add 5 percent of the Subcontractor's total cost for the extra work. Regardless of the number of hierarchical tiers of Subcontractors, the 5 percent increase above the Subcontractor's total cost which includes the allowances for overhead and profit specified herein may be applied one time only.

11.5 EXCLUDED COSTS. The term "Cost of the Work" shall not include any of the following:

- A. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, estimators, attorneys' auditors, accountants, purchasing and contracting agents, expenditures, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in CONTRACTOR's principal or a branch office for general administration of the work, or not specifically covered by paragraph 11.3, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.
- B. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.
- C. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the WORK and charges against CONTRACTOR for delinquent payments.
- D. Cost of premiums for all bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by paragraph 11.4 above).
- E. Costs due to the negligence of CONTRACTOR , any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of Defective WORK, disposal of materials or equipment wrongly supplied and making good any damage to property.
- F. Other overhead or general expense costs of any kind and the cost of any item not specifically and expressly included in paragraph 11.4.

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ARTICLE 12 CHANGE OF CONTRACT TIME

12.1 GENERAL

- A. The Contract Time may only be changed by a Change Order. Any claim for an extension of the Contract Time (or Milestones) shall be based on written notice delivered by the CONTRACTOR to the ENGINEER promptly (but in no event later than 30 days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within 60 days after such occurrence (unless the ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR's written statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time shall be determined by the ENGINEER in accordance with Paragraph 9.8 if the OWNER and the CONTRACTOR cannot otherwise agree. No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this Paragraph 12.1A. An increase in Contract Time does not mean that the Contractor is due an increase in Contract Price. Only compensable time extensions will result in an increase in Contract Price.
- B. All time limits stated in the Contract Documents are of the essence of the Agreement.
- C. Where CONTRACTOR is prevented from completing any part of the WORK within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost on the critical path of the project due to such delay if a claim is made therefor as provided in paragraph 12.1. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, unprecedented weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.
- D. Where CONTRACTOR is prevented from completing any part of the WORK within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost on the critical path of the project due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay. In no event shall the OWNER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (i) delays caused by or within the control of CONTRACTOR, or (ii) delays beyond the control of both parties including but not limited to fires, floods, epidemics abnormal weather conditions, acts of God or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

- 12.2 EXTENSIONS OF TIME FOR DELAY DUE TO WEATHER. Contract Time may be extended by the ENGINEER because of delays in completion of the WORK due to unusually severe weather, provided that the CONTRACTOR shall, within 10 days of the beginning of any such delay, notify the ENGINEER in writing of the cause of delay and request an extension of Contract Time. The

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ENGINEER will ascertain the facts and the extent of the delay and extend the time for completing the work when, in the ENGINEER's judgment, the findings of fact justify such an extension. Unprecedented, abnormal, or unusually severe weather will be defined as an event, or events, with a greater than 50-year recurrence interval, as determined by the National Weather Service, or equivalent State or Federal agency

ARTICLE 13 WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

- 13.1 **WARRANTY AND GUARANTEE.** The CONTRACTOR warrants and guarantees to the OWNER and the ENGINEER that all work will be in accordance with the Contract Documents and will not be defective. Prompt notice of defects known to the OWNER or ENGINEER shall be given to the CONTRACTOR. All defective work, whether or not in place, may be rejected, corrected, or accepted as provided in this Article 13.
- 13.2 **ACCESS TO WORK.** OWNER, ENGINEER, their Consultants, sub-consultants, other representatives and personnel of OWNER, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the WORK at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.
- 13.3 **TESTS AND INSPECTIONS**
- A. The CONTRACTOR shall give the ENGINEER timely notice of readiness of the WORK for all required inspections, tests, or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
 - B. If Laws or Regulations of any public body having jurisdiction other than the OWNER require any WORK to specifically be inspected, tested, or approved, the CONTRACTOR shall pay all costs in connection therewith. The CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with the OWNER's or the ENGINEER's acceptance of a Supplier of materials or equipment proposed as a substitution or (or-equal) to be incorporated in the WORK, or of materials or equipment submitted for review prior to the CONTRACTOR's purchase thereof for incorporation in the WORK. The cost of all inspections, tests, and approvals in addition to the above which are required by the Contract Documents shall be paid by the OWNER (unless otherwise specified).
 - C. The ENGINEER will make, or have made, such inspections and tests as the ENGINEER deems necessary to see that the WORK is being accomplished in accordance with the requirements of the Contract Documents. Unless otherwise specified in the Supplementary General Conditions, the cost of such inspection and testing will be borne by the OWNER. In the event such inspections or tests reveal non-compliance with the requirements of the Contract Documents, the CONTRACTOR shall bear the cost of corrective measures deemed necessary by the ENGINEER, as well as the cost of subsequent reinspection and retesting. Neither observations by the ENGINEER nor inspections, tests, or approvals by others shall relieve the CONTRACTOR from the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.

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- D. All inspections, tests, or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to the ENGINEER and the CONTRACTOR.
 - E. If any WORK (including the work of others) that is to be inspected, tested, or approved is covered without written concurrence of the ENGINEER, it must, if requested by the ENGINEER, be uncovered for observation. Such uncovering shall be at the CONTRACTOR's expense unless the CONTRACTOR has given the ENGINEER timely notice of the CONTRACTOR's intention to perform such test or to cover the same and the ENGINEER has not acted with reasonable promptness in response to such notice.
 - F. If any WORK is covered contrary to the written request of the ENGINEER, it must, if requested by the ENGINEER, be uncovered for the ENGINEER's observation and recovered at the CONTRACTOR's expense.
 - G. If the ENGINEER considers it necessary or advisable that covered WORK be observed by the ENGINEER or inspected or tested by others, the CONTRACTOR, at the ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as the ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, material, and equipment. If it is found that such WORK is defective, the CONTRACTOR shall bear all direct, indirect, and consequential costs and damages of such uncovering, exposure, observation, inspection, and testing and of satisfactory reconstruction, including but not limited to fees and charges of engineers, attorneys, and other professionals. However, if such WORK is not found to be defective, the CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, the CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.
- 13.4 OWNER MAY STOP THE WORK. If the WORK is defective, or the CONTRACTOR fails to perform work in such a way that the completed WORK will conform to the Contract Documents, the OWNER may order the CONTRACTOR to stop the WORK, or any portion thereof, until the cause for such order has been eliminated; however, this right of the OWNER to stop the WORK shall not give rise to any duty on the part of the OWNER to exercise this right for the benefit of the CONTRACTOR or any other party.
- 13.5 CORRECTION OR REMOVAL OF DEFECTIVE WORK. If required by the ENGINEER, the CONTRACTOR shall promptly, either correct all defective work, whether or not fabricated, installed, or completed, or, if the WORK has been rejected by the ENGINEER, remove it from the site and replace it with non-defective work. The CONTRACTOR shall bear all direct, indirect and consequential costs and damages of such correction or removal, including but not limited to fees and charges of engineers, attorneys, and other professionals made necessary thereby.

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13.6 ONE YEAR CORRECTION PERIOD

- A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any work is found to be defective, the CONTRACTOR shall promptly, without cost to the OWNER and in accordance with OWNER's written notification, (i) correct such Defective WORK, or, if it has been rejected by the OWNER, remove it from the site and replace it with non-defective work, and (ii) satisfactorily correct or remove and replace any damage to other work of others resulting therefrom. If the CONTRACTOR does not promptly comply with such notification, or in an emergency where delay would cause serious risk of loss or damage, the OWNER may have the Defective WORK corrected or the rejected WORK removed and replaced, and all direct, indirect, and consequential costs and damages of such removal and replacement including but not limited to fees and charges of engineers, attorneys and other professionals will be paid by the CONTRACTOR.
- B. Where Defective WORK (and damage to other WORK resulting therefrom) has been corrected, removed or replaced under this paragraph 13.6, the correction period hereunder with respect to such WORK will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

13.7 ACCEPTANCE OF DEFECTIVE WORK. If, instead of requiring correction or removal and replacement of defective work, the OWNER prefers to accept the WORK, the OWNER may do so. The CONTRACTOR shall bear all direct, indirect, and consequential costs attributable to the OWNER's evaluation of and determination to accept such defective work. If any such acceptance occurs prior to final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the WORK, and the OWNER shall be entitled to an appropriate decrease in the Contract Price.

ARTICLE 14 PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 SCHEDULE OF VALUES (LUMP SUM PRICE BREAKDOWN). The schedule of values or lump sum price breakdown established as provided in the General Requirements shall serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to the ENGINEER.

14.2 UNIT PRICE BID SCHEDULE. Progress payments on account of Unit Price work will be based on the number of units completed.

14.3 APPLICATION FOR PROGRESS PAYMENT

- A. Unless otherwise prescribed by law, on the 25th of each month, the CONTRACTOR shall submit to the ENGINEER for review, an Application for Payment filled out and signed by the CONTRACTOR covering the WORK completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
- B. The Application for Payment shall identify, as a sub-total, the amount of the CONTRACTOR'S Total Earnings to Date, plus the Value of Materials Stored at the Site which have not yet been incorporated in the WORK, and less a deductive adjustment for

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materials installed which were not previously incorporated in the WORK, but for which payment was allowed under the provisions for payment for Materials Stored at the Site, but not yet incorporated in the WORK.

- C. The Net Payment Due the CONTRACTOR shall be the above-mentioned subtotal from which shall be deducted the total amount of all previous payments made to the CONTRACTOR. Progress payments will be paid in full in accordance with Article 14 of the General Conditions until 90% of the Contract Price has been paid. The remaining 10% of the Contract Price amount may be withheld until:

1. final inspection has been made;
2. completion of the Project; and
3. acceptance of the Project by the OWNER.

- D. The Value of Materials Stored at the Site shall be an amount equal to the specified percent of the value of such materials as set forth in the Supplementary General Conditions. Said amount shall be based upon the value of all acceptable materials and equipment not incorporated in the WORK but delivered and suitably stored at the site or at another location agreed to in writing; provided, each such individual item has a value of more than \$5,000.00 and will become a permanent part of the WORK. The Application for Payment shall also be accompanied by an invoice (including shipping), a certification that the materials meet the applicable contract specifications, and any evidence required by the OWNER that the materials and equipment are covered by appropriate property insurance and other arrangements to protect the OWNER's interest therein, all of which will be satisfactory to the OWNER. Payment for materials will not constitute final acceptance. It shall be the CONTRACTOR's responsibility to protect the material from damage, theft, loss, or peril while in storage. Unless otherwise prescribed by law, the Value of Materials Stored at the Site shall be paid at the invoice amount up to a maximum of 85% of the Contract Price for those items.

- 14.4 CONTRACTOR'S WARRANTY OF TITLE. The CONTRACTOR warrants and guarantees that title to all work, materials, and equipment covered by an Application for Payment, whether incorporated in the WORK or not, will pass to the OWNER no later than the time of payment free and clear of all liens.

14.5 REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT

- A. The ENGINEER will, within 7 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to the OWNER, or return the Application to the CONTRACTOR indicating in writing the ENGINEER's reasons for refusing to recommend payment. In the later case, the CONTRACTOR may make the necessary corrections and resubmit the Application. If the ENGINEER still disagrees with a portion of the Application, it will submit the Application recommending the undisputed portion of the Application to the OWNER for payment and provide reasons for recommending non-payment of the disputed amount. Thirty days after presentation of the Application for Payment with the ENGINEER's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.5B) become due and when due will be paid by the OWNER to the CONTRACTOR.

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- B. The OWNER may refuse to make payment of the full amount recommended by the ENGINEER because claims have been made against the OWNER on account of the CONTRACTOR's performance of the WORK or Liens have been filed in connection with the WORK or there are other items entitling the OWNER to a credit against the amount recommended, but the OWNER must give the CONTRACTOR written notice within 7 days (with a copy to the ENGINEER) stating the reasons for such action.

14.6 PARTIAL UTILIZATION

- A. The OWNER shall have the right to utilize or place into service any item of equipment or other usable portion of the WORK prior to completion of the WORK. Whenever the OWNER plans to exercise said right, the CONTRACTOR will be notified in writing by the OWNER, identifying the specific portion or portions of the WORK to be so utilized or otherwise placed into service.
- B. It shall be understood by the CONTRACTOR that until such written notification is issued, all responsibility for care and maintenance of all of the WORK shall be borne by the CONTRACTOR. Upon issuance of said written notice of partial utilization, the OWNER will accept responsibility for the protection and maintenance of all such items or portions of the WORK described in the written notice.
- C. The CONTRACTOR shall retain full responsibility for satisfactory completion of the WORK, regardless of whether a portion thereof has been partially utilized by the OWNER and the CONTRACTOR's one year correction period shall commence only after the date of Substantial Completion for the WORK.

14.7 SUBSTANTIAL COMPLETION. When the CONTRACTOR considers the WORK ready for its intended use the CONTRACTOR shall notify the OWNER and the ENGINEER in writing that the WORK is substantially complete. The CONTRACTOR will attach to this request a list of all work items that remain to be completed and a request that the ENGINEER prepare a Notice of Completion. Within a reasonable time thereafter, the OWNER, the CONTRACTOR, and the ENGINEER shall make an inspection of the WORK to determine the status of completion. If the ENGINEER does not consider the WORK substantially complete, or the list of remaining work items to be comprehensive, the ENGINEER will notify the CONTRACTOR in writing giving the reasons therefor. If the ENGINEER considers the WORK substantially complete, the ENGINEER will prepare and deliver to the OWNER, for its execution and recording, the Notice of Completion signed by the ENGINEER and CONTRACTOR, which shall fix the date of Substantial Completion.

14.8 FINAL APPLICATION FOR PAYMENT. After the CONTRACTOR has completed all of the remaining work items referred to in Paragraph 14.7 and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, record as-built documents (as provided in the General Requirements) and other documents, all as required by the Contract Documents, and after the ENGINEER has indicated that the WORK is acceptable, the CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents, together with complete and legally effective releases or waivers (satisfactory to the OWNER) of all liens arising out of or filed in connection with the WORK.

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14.9 FINAL PAYMENT AND ACCEPTANCE

- A. If, on the basis of the ENGINEER's observation of the WORK during construction and final inspection, and the ENGINEER's review of the final Application for Payment and accompanying documentation, all as required by the Contract Documents, the ENGINEER is satisfied that the WORK has been completed and the CONTRACTOR's other obligations under the Contract Documents have been fulfilled, the ENGINEER will, within 14 days after receipt of the final Application for Payment, indicate in writing the ENGINEER's recommendation of payment and present the Application to the OWNER for payment.
- B. After acceptance of the WORK by the OWNER's governing body, the OWNER will make final payment to the CONTRACTOR of the amount remaining after deducting all prior payments and all amounts to be kept or retained under the provisions of the Contract Documents, including the following items:
 - 1. Liquidated damages, as applicable.
 - 2. Two times the value of outstanding items of correction work or punch list items yet uncompleted or uncorrected, as applicable. All such work shall be completed or corrected to the satisfaction of the OWNER within the time stated on the Notice of Completion, otherwise the CONTRACTOR does hereby waive any and all claims to all monies withheld by the OWNER to cover the value of all such uncompleted or uncorrected items.

14.10 RELEASE OF RETAINAGE AND OTHER DEDUCTIONS

- A. After executing the necessary documents to initiate the lien period, and not more than 45 days thereafter (based on a 30-day lien filing period and 15-day processing time), the OWNER will release to the CONTRACTOR the retainage funds withheld pursuant to the Agreement, less any deductions to cover pending claims against the OWNER pursuant to Paragraph 14.5B.
- B. After filing of the necessary documents to initiate the lien period, the CONTRACTOR shall have 30 days to complete any outstanding items of correction work remaining to be completed or corrected as listed on a final punch list made a part of the Notice of Completion. Upon expiration of the 45 days, referred to in Paragraph 14.10A, the amounts withheld pursuant to the provisions of Paragraph 14.9B herein, for all remaining work items will be returned to the CONTRACTOR; provided, that said work has been completed or corrected to the satisfaction of the OWNER within said 30 days. Otherwise, the CONTRACTOR does hereby waive any and all claims for all monies withheld by the OWNER under the Contract to cover 2 times the value of such remaining uncompleted or uncorrected items.

- 14.11 CONTRACTOR'S CONTINUING OBLIGATION. The CONTRACTOR's obligation to perform and complete the WORK in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by the ENGINEER, nor the issuance of a Notice of Completion, nor any payment by the OWNER to the CONTRACTOR under the Contract Documents, nor any use or occupancy of the WORK or any part thereof by the OWNER, nor any act of acceptance by the OWNER nor any failure to do so, nor any review of a Shop Drawing or sample submittal, will constitute an acceptance of work not in accordance with the Contract Documents or a release of the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.

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- 14.12 FINAL PAYMENT TERMINATES LIABILITY OF OWNER. Final payment is defined as the last progress payment made to the CONTRACTOR for earned funds, less monies withheld as applicable, pursuant to Paragraph 14.10A. The acceptance by the CONTRACTOR of the final payment referred to in Paragraph 14.9 herein, shall be a release of the OWNER and its agents from all claims of liability to the CONTRACTOR for anything done or furnished for, or relating to, the WORK or for any act of neglect of the OWNER or of any person relating to or affecting the WORK, except demands against the OWNER for the remainder, if any, of the amounts kept or retained under the provisions of Paragraph 14.9 herein; and excepting pending, unresolved claims filed prior to the date of the Notice of Completion.

ARTICLE 15 SUSPENSION OF WORK AND TERMINATION

- 15.1 SUSPENSION OF WORK BY OWNER. The OWNER, acting through the ENGINEER, may, at any time and without cause, suspend the WORK or any portion thereof for a period of not more than 90 days by notice in writing to the CONTRACTOR. The CONTRACTOR shall resume the WORK on receipt from the ENGINEER of a notice of resumption of work. The CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if the CONTRACTOR makes an approved claim therefor as provided in Articles 11 and 12.
- 15.2 TERMINATION OF AGREEMENT BY OWNER (CONTRACTOR DEFAULT)
- A. In the event of default by the CONTRACTOR, the OWNER may give 10 days written notice to the CONTRACTOR of OWNER's intent to terminate the Agreement and provide the CONTRACTOR an opportunity to remedy the conditions constituting the default. It shall be considered a default by the CONTRACTOR whenever CONTRACTOR shall: (1) declare bankruptcy, become insolvent, or assign its assets for the benefit of its creditors; (2) fail to provide materials or quality of work meeting the requirements of the Contract Documents; (3) disregard or violate provisions of the Contract Documents or ENGINEER's instructions; (4) fail to prosecute the WORK according to the approved progress schedule; or, (5) fail to provide a qualified superintendent, competent workers, or materials or equipment meeting the requirements of the Contract Documents. If the CONTRACTOR fails to remedy the conditions constituting default within the time allowed, the OWNER may then issue the Notice of Termination.
- B. In the event the Agreement is terminated in accordance with Paragraph 15.2A, herein, the OWNER may take possession of the WORK and may complete the WORK by whatever method or means the OWNER may select. The cost of completing the WORK shall be deducted from the balance which would have been due the CONTRACTOR had the Agreement not been terminated and the WORK completed in accordance with the Contract Documents. If such cost exceeds the balance which would have been due, the CONTRACTOR shall pay the excess amount to the OWNER. If such cost is less than the balance which would have been due, the CONTRACTOR shall not have claim to the difference.
- 15.3 TERMINATION OF AGREEMENT BY OWNER (FOR CONVENIENCE). The OWNER may terminate the Agreement at any time if it is found that reasons beyond the control of either the OWNER or CONTRACTOR make it impossible or against the OWNER's interests to complete the WORK. In such a case, the CONTRACTOR shall have no claims against the OWNER except: (1) for

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the value of work performed up to the date the Agreement is terminated; and, (2) for the cost of materials and equipment on hand, in transit, or on definite commitment, as of the date the Agreement is terminated which would be needed in the WORK and which meet the requirements of the Contract Documents. The value of work performed and the cost of materials and equipment delivered to the site, as mentioned above, shall be determined by the ENGINEER in accordance with the procedure prescribed for the making of the final application for payment and payment under Paragraphs 14.8 and 14.9.

- 15.4 TERMINATION OF AGREEMENT BY CONTRACTOR. The CONTRACTOR may terminate the Agreement upon 10 days written notice to the OWNER, whenever: 1) the WORK has been suspended under the provisions of Paragraph 15.1, herein, for more than 90 consecutive days through no fault or negligence of the CONTRACTOR, and notice to resume work or to terminate the Agreement has not been received from the OWNER within this time period; or, 2) the OWNER should fail to pay the CONTRACTOR any monies due him in accordance with the terms of the Contract Documents and within 60 days after presentation to the OWNER by the CONTRACTOR of a request therefor, unless within said 10-day period the OWNER shall have remedied the condition upon which the payment delay was based. In the event of such termination, the CONTRACTOR shall have no claims against the OWNER except for those claims specifically enumerated in Paragraph 15.3, herein, and as determined in accordance with the requirements of said paragraph.

ARTICLE 16 MISCELLANEOUS

- 16.1 GIVING NOTICE. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

16.2 RIGHTS IN AND USE OF MATERIALS FOUND ON THE WORK

- A. The CONTRACTOR may use on the Project, with ENGINEER's approval, such stone, gravel, sand, or other material determined suitable by the ENGINEER, as may be found in the excavation. The CONTRACTOR will be paid for the excavation of such material at the corresponding contract unit price. No additional payment will be made for utilizing the material from excavation as borrow, or select borrow.
- B. The CONTRACTOR shall replace, at its own expense, with other acceptable material, all of that portion of the excavated material so removed and used which was needed for use on the project. No charge for the materials so used will be made against the CONTRACTOR except that the CONTRACTOR shall be responsible for payment of any royalties required.
- C. The CONTRACTOR shall not excavate or remove any material from within the Project location which is not within the grading limits, as indicated by the slope and grade lines, without written authorization from the ENGINEER.
- D. In the event the CONTRACTOR has processed materials from OWNER-furnished sources in excess of the quantities required for performance of this contract, including any waste material produced as a by-product, the CBJ may retain possession of such materials without obligation to reimburse the CONTRACTOR for the cost of their production. When such

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materials are in a stockpile, the ENGINEER may require: That it remain in stockpile; the CONTRACTOR level such stockpile(s); or that the CONTRACTOR remove such materials and restore the premises to a satisfactory condition at the CONTRACTOR's expense. This provision shall not preclude the CBJ from arranging with the CONTRACTOR to produce material over and above the contract needs, payment for which shall be by written agreement between the CBJ and the CONTRACTOR.

- E. Unless otherwise provided, the material from any existing old structure may be used temporarily by the CONTRACTOR in the erection of the new structure. Such material shall not be cut or otherwise damaged except with the approval of the ENGINEER.
- 16.3 **RIGHT TO AUDIT.** If the CONTRACTOR submits a claim to the OWNER for additional compensation, the OWNER shall have the right, as a condition to considering the claim, and as a basis for evaluation of the claim, and until the claim has been settled, to audit the CONTRACTOR's books to the extent they are relevant. This right shall include the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to discover and verify all direct and indirect costs of whatever nature claimed to have been incurred or anticipated to be incurred and for which the claim has been submitted. The right to audit shall include the right to inspect the CONTRACTOR's plants, or such parts thereof, as may be or have been engaged in the performance of the WORK. The CONTRACTOR further agrees that the right to audit encompasses all subcontracts and is binding upon Subcontractors. The rights to examine and inspect herein provided for shall be exercisable through such representatives as the OWNER deems desirable during the CONTRACTOR's normal business hours at the office of the CONTRACTOR. The CONTRACTOR shall make available to the OWNER for auditing, all relevant accounting records and documents, and other financial data, and upon request, shall submit true copies of requested records to the OWNER.
- 16.4 **ARCHEOLOGICAL OR HISTORICAL DISCOVERIES.** When the CONTRACTOR's operation encounters prehistoric artifacts, burials, remains of dwelling sites, paleontological remains, such as shell heaps, land or sea mammal bones or tusks, or other items of historical significance, the CONTRACTOR shall cease operations immediately and notify the ENGINEER. No artifacts or specimens shall be further disturbed or removed from the ground and no further operations shall be performed at the site until so directed. Should the ENGINEER order suspension of the CONTRACTOR's operations in order to protect an archaeological or historical finding, or order the CONTRACTOR to perform extra work, such order(s) shall be covered by an appropriate contract change document.
- 16.5 **CONSTRUCTION OVER OR ADJACENT TO NAVIGABLE WATERS.** All work over, on, or adjacent to navigable waters shall be so conducted that free navigation of the waterways will not be interfered with and the existing navigable depths will not be impaired, except as allowed by permit issued the U.S. Coast Guard and/or the U.S. Army Corps of Engineers, as applicable.
- 16.6 **GRATUITY AND CONFLICT OF INTEREST.** The CONTRACTOR agrees to not extend any loan, gratuity or gift of money of any form whatsoever to any employee or elected official of the OWNER, nor will the CONTRACTOR rent or purchase any equipment or materials from any employee or elected official of the OWNER, or to the best of the CONTRACTOR's knowledge, from any agent of any employee or elected official of the OWNER. Before final payment, the CONTRACTOR shall execute and furnish the OWNER an affidavit certifying that the CONTRACTOR has complied with the above provisions of the contract.

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16.7 SUITS OF LAW CONCERNING THE WORK

- A. Should a suit of law be entered into, either by the CONTRACTOR (or the CONTRACTOR's surety) against the OWNER, or by the OWNER against the CONTRACTOR (or the CONTRACTOR's surety), the suit of law shall be tried in the First Judicial District of Alaska.
- B. If one of the questions at issue is the satisfactory performance of the work by the CONTRACTOR and should the appropriate court of law judge the work of the CONTRACTOR to be unsatisfactory, then the CONTRACTOR (or the CONTRACTOR's surety) shall reimburse the OWNER for all legal and all other expenses (as may be allowed and set by the court) incurred by the OWNER because of the suit of the law and, further, it is agreed that the OWNER may deduct such expense from any sum or sums then, or any that become due the CONTRACTOR under the contract.

16.8 CERTIFIED PAYROLLS

- A. All CONTRACTORs or Subcontractor who perform work on a public construction contract for the OWNER shall file a certified payroll with the Alaska Department of Labor before Friday of each week that covers the preceding week (Section 14-2-4 ACLA 1949; am Section 4 ch 142 SLA 1972).
- B. In lieu of submitting the State payroll form, the CONTRACTOR's standard payroll form may be submitted, provided it contains the information required by AS 36.05.040 and a statement that the CONTRACTOR is complying with AS 36.10.010.
- C. A contractor or subcontractor, who performs work on public construction in the State, as defined by AS 36.95.010(3), shall pay not less than the current prevailing rate of wages as issued by the Alaska Department of Labor before the end of the pay period. (AS 36.05.010).

16.9 PREVAILING WAGE RATES

- A. Wage rates for Laborers and Mechanics on Public Contracts, AS 36.05.070. The CONTRACTOR, or Subcontractors, shall pay all employees unconditionally and not less than once a week. Wages may not be less than those stated in Paragraph 16.8C, regardless of the contractual relationship between the CONTRACTOR or Subcontractors and laborers, mechanics, or field surveyors. The scale of wages to be paid shall be posted by the CONTRACTOR in a prominent, easily accessible place at the site of the WORK.
- B. Failure to Pay Agreed Wages, AS 36.05.080. If it is found that a laborer, mechanic, or field surveyor employed by the CONTRACTOR or Subcontractor has been, or is being, paid a rate or wages less than the established rate, the OWNER may, by written notice, terminate the CONTRACTOR or Subcontractors right to proceed with the work. The OWNER may prosecute the work to completion by contract or otherwise, and the CONTRACTOR and sureties will be held liable to the OWNER for excess costs for completing the WORK. (Section 2 ch 52 SLA 1959).
- C. Listing Contractor's Who Violate Contracts, AS 36.05.090. In addition, a list giving the names of persons who have disregarded the rights of their employees shall be distributed to all departments of State government and all political subdivisions. No person appearing on this

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list, and no firm, corporation, partnership or association in which the person has an interest, may work as a CONTRACTOR or Subcontractor on a public construction contract for the State, or a political subdivision of the state, until three years after the date of publication of the list. (Section 3 ch 52 SLA 1959; am Section 9 ch 142 SLA).

16.10 EMPLOYMENT REFERENCE. Workers employed in the execution of the contract by the CONTRACTOR or by any Subcontractor under this contract shall not be required or permitted to labor more than 8 hours a day or 40 hours per week in violation of the provisions of the Alaska Wage and Hour Act, Section 23.10.060.

16.11 COST REDUCTION INCENTIVE

- A. At any time within 45 days after the date of the Notice of Award, the CONTRACTOR may submit to the ENGINEER in writing, proposals for modifying the plans, specifications, or other requirements of this contract for the sole purpose of reducing the total cost of construction. The cost reduction proposal shall not impair in any manner the essential functions or characteristics of the project, including but not limited to, service life, economy of operation, ease of maintenance, desired appearance or design and safety standards.
- B. The cost reduction proposal shall contain the following information:
1. Description of both the existing contract requirements for performing the WORK and the proposed changes.
 2. An itemization of the contract requirements that must be changed if the proposal is adopted.
 3. A detailed estimate of the time required and the cost of performing the WORK under both the existing contract and the proposed change.
 4. A statement of the date by which the CONTRACTOR must receive the decision from the OWNER on the cost reduction proposal.
 5. The contract items of WORK effected by the proposed changes including any quantity variations.
 6. A description and estimate of costs the OWNER may incur in implementing the proposed changes, such as test and evaluation and operating and support costs.
 7. A prediction of any effects the proposed change would have on future operations and maintenance costs to the OWNER.
- C. The provisions of this section shall not be construed to require the OWNER to consider any cost reduction proposal which may be submitted; nor will the OWNER be liable to the CONTRACTOR for failure to accept or act upon any cost reduction proposal submitted, or for delays to the work attributable to the consideration or implementation of any such proposal.
- D. If a cost reduction proposal is similar to a change in the plans or specifications for the project under consideration by the OWNER at the time the proposal is submitted, the OWNER will not accept such proposal and reserves the right to make such changes without compensation to the CONTRACTOR under the provisions of this section.
- E. The CONTRACTOR shall continue to perform the work in accordance with the requirements of the contract until an executed Change Order incorporating the cost reduction proposal has

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been issued. If any executed Change Order has not been issued by the date upon which the CONTRACTOR's cost reduction proposal specifies that a decision should be made by the OWNER, in writing, the cost reduction proposal shall be considered rejected.

- F. The OWNER, shall be the sole judge of the acceptability of a cost reduction proposal and of the estimated net savings in Contract Time and construction costs resulting from the adoption of all or any part of such proposal. Should the CONTRACTOR disagree with OWNER's decision on the cost reduction proposal, there is no further consideration. The OWNER reserves the right to make final determination.
- G. If the CONTRACTOR's cost reduction proposal is accepted in whole or in part, such acceptance will be made by a contract Change Order, which specifically states that the change is executed pursuant to this cost reduction proposal section. Such Change Order shall incorporate the changes in the plans and specifications which are necessary to permit the cost reduction proposal or such part of it as has been accepted to be put into effect and shall include any conditions upon which the OWNER's approval is based, if such approval is conditional. The Change Order shall also describe the estimated net savings in the cost of performing the work attributable to the cost reduction proposal, and shall further provide that the contract cost be adjusted by crediting the OWNER with the estimated net savings amount.
- H. Acceptance of the cost reduction proposal and performance of the work does not extend the time of completion of the contract, unless specifically provided in the Change Order authorizing the use of the submitted proposal. Should the adoption of the cost reduction proposal result in a Contract Time savings, the total Contract Time shall be reduced by an amount equal to the time savings realized.
- I. The amount specified to the CONTRACTOR in the Change Order accepted in the cost reduction proposal shall constitute full compensation for the performance of WORK. No claims for additional costs as a result of the changes specified in the cost reduction proposal shall be allowed.
- J. The OWNER reserves the right to adopt and utilize any approved cost reduction proposal for general use on any contract administered when it is determined suitable for such application. Cost reduction proposals identical, similar, or previously submitted will not be accepted for consideration if acceptance and compensation has previously been approved. The OWNER reserves the right to use all or part of any cost reduction proposal without obligation or compensation of any kind to the CONTRACTOR.
- K. The CONTRACTOR shall bear the costs, if any, to revise all bonds and insurance requirements for the project, to include the cost reduction WORK.

END OF SECTION

SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS

GENERAL. These Supplementary General Conditions make additions, deletions, or revisions to the General Conditions as indicated herein. All provisions which are not so added, deleted, or revised remain in full force and effect. Terms used in these Supplementary General Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

SGC 1 DEFINITIONS. *Remove* the definition for Contract Documents and *replace* with the following:

Contract Documents – The Table of Contents, Notice Inviting Bids, Instructions to Bidders, Bid Forms (including the Bid, Bid Schedule(s), Subcontractor Report, Bid Bond, and all required certificates and affidavits), Agreement, Performance Bond, Payment Bond, General Conditions, Supplementary General Conditions, Alaska Labor Standards, Reporting, and Prevailing Wage Rate Determination, Special Provisions, Standard Specifications, Technical Specifications, Drawings, Permits, and all Addenda, and Change Orders executed pursuant to the provisions of the Contract Documents.

SGC 2.2 COPIES OF DOCUMENTS. *Add* the following:

The OWNER shall furnish to the CONTRACTOR two (2) hard copies of the Contract Documents, which will include bound reduced Drawings, and electronic files of the documents in pdf format. Additional copies of contract documents are the responsibility of the contractor.

SGC 3.2 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS. *Remove* No. 12. Technical Specifications and No. 13. Drawings, and *add* the following:

12. Special Provisions Section
13. Standard Specifications for Civil Engineering Projects and Subdivision Improvements
December 2003 Edition with current Errata Sheets.
14. Drawings.

SGC 4.2 PHYSICAL CONDITIONS - SUBSURFACE AND EXISTING STRUCTURES. *Add* the following:

- C. In the preparation of the Contract Documents, the Engineer of Record has relied upon field measurements and visual inspection of the existing structures and surface conditions.

SGC - 4.6 USE OF THE CBJ/STATE LEMON CREEK GRAVEL PIT. *Add* the following.

The CBJ/State Lemon Creek Gravel Pit is not available for this Project.

SGC 5.1 PERFORMANCE, PAYMENT, AND OTHER BONDS. The Contractor shall furnish Performance and Payment Bonds in the amount of 100% of the Bid.

SGC 5.2 INSURANCE AMOUNTS. The limits of liability for the insurance required by Paragraph 5.2 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations. The CONTRACTOR must provide certification of proper insurance coverage and amendatory endorsements or copies of the applicable policy language affecting coverage required in this agreement to the City and Borough of Juneau. All certificates of insurance supplied to the OWNER shall state that the OWNER is named as “**Additional Insured for any and all work performed for the City & Borough of Juneau**” for the **Commercial General Liability policy and any other policies, if required**

SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS

in this Section. NOTE: This requirement has changed. The OWNER no longer requires certificates of insurance referencing project names and contract numbers.

Delete paragraph C and Replace with the following paragraph C:

C. The CONTRACTOR shall furnish the OWNER with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Failure of CBJ to demand such certificate or other evidence of full compliance with these insurance requirements or failure of CBJ to identify a deficiency from evidence that is provided shall not be construed as a waiver of the obligation of the Contractor to maintain the insurance required by this contract. The coverage afforded will not be cancelled, reduced in coverage, or renewal refused until at least 30 days' prior written notice has been given to the OWNER by the CONTRACTOR. All such insurance required herein (except for Workers' Compensation and Employer's Liability) shall name the OWNER, its Consultants and subconsultants and their officers, directors, agents, and employees as "additional insureds" under the policies.

The CONTRACTOR shall purchase and maintain the following insurance:

1. Workers' Compensation and Employer's Liability. This insurance shall protect the CONTRACTOR against all claims under applicable state workers' compensation laws. The CONTRACTOR shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a Workers' Compensation law. The CONTRACTOR shall require each Subcontractor similarly to provide Workers' Compensation Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the protection afforded by the CONTRACTOR's Workers' Compensation Insurance. In case any class of employees is not protected, under the Workers' Compensation Statute, the CONTRACTOR shall provide and shall cause each subcontractor to provide adequate employer's liability insurance for the protection of such of its employees as are not otherwise protected. The CONTRACTOR grants a waiver of any right to subrogation against the OWNER by virtue of the payment of any loss under such insurance. This provision applies regardless of whether or not the OWNER has received a waiver of subrogation endorsement from the insurer.

Workers' Compensation: (under Paragraph 5.2C.1 of the General Conditions) as in accordance with AS 23.30.045:

- a. State: Statutory
b. Applicable Federal (e.g., Longshore): Statutory

Note: If the WORK called for in the Contract Documents involves work in or on any navigable waters, the CONTRACTOR shall provide Workers' Compensation coverage which shall include coverage under the Longshore and Harbor Workers' Compensation Act, the Jones Act, and any other coverage required under Federal or State laws pertaining to workers in or on navigable waters.

- a. Employers Liability
Bodily Injury by Accident: \$1,000,000.00 Each Accident
Bodily Injury by Disease: \$1,000,000.00 Each Employee
Bodily Injury by Disease: \$1,000,000.00 Policy Limit

SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS

SGC 6.5 CONCERNING SUBCONTRACTORS, SUPPLIERS, AND OTHERS. *Add* the following:

B. The CONTRACTOR shall perform not less than 40% of the WORK with its own forces (i.e., without subcontracting). The 40% requirement shall be understood to mean that the CONTRACTOR shall perform, with its own organization, WORK amounting to at least 40% of the original contract amount. The 40% requirement will be calculated based upon the total of the subcontract amounts submitted for Contract Award, and any other information requested by the OWNER from the apparent low Bidder.

SGC 6.5 CONCERNING SUBCONTRACTORS, SUPPLIERS, AND OTHERS, *Add* the following paragraph:

C. CONTRACTOR must pay Subcontractors and/or Suppliers within 30 days of receiving payment from the OWNER, if that payment was made for Work performed by the Subcontractor and/or materials received. Failure to pay Subcontractors within 30 days of receiving payment from which Subcontractor and/or Supplier is to be paid may result in the OWNER initiating debarment proceedings as prescribed in the City and Borough of Juneau Purchasing Code. *The 30 day City and Borough of Juneau requirement does not supersede AS 36.90.210.*

SGC 6.6 PERMITS, *Add* the following paragraph:

D. Contractor is responsible for obtaining a Hot Works permit from the CBJ Permit Center, if performing work which requires such a permit. Work requiring a Hot Works Permit includes but is not limited to the following: cutting, welding, Thermit welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof systems or any other similar activity.

SGC 14.3 APPLICATION FOR PROGRESS PAYMENT. Paragraph D.

D. The Value of Materials Stored at the site shall be an amount equal to 85%.

SGC 14.9 FINAL PAYMENT AND ACCEPTANCE. *Add* the following paragraph:

C. Prior to the final payment the CONTRACTOR shall contact the Alaska Department of Labor and Workforce Development (ADOL) and provide the OWNER with clearance from the ADOL for the CONTRACTOR and all Subcontractors that have worked on the Project. This clearance shall indicate that all Employment Security Taxes have been paid. A sample form for this purpose is at the end of this section. The CONTRACTOR shall also submit a "NOTICE OF COMPLETION OF PUBLIC WORKS" signed by ADOL.

SGC 16.8 CERTIFIED PAYROLLS. *Change* paragraph A. to read:

A. All CONTRACTORs or Subcontractors who perform work on a public construction contract for the OWNER shall file a certified payroll with Alaska Department of Labor. See Section 00830 - Alaska Labor Standards, Reporting, and Prevailing Wage Rate Determination.

Add the following SGC 16.12.

SGC 16.12 EQUAL EMPLOYMENT OPPORTUNITY (EEO)

The CONTRACTOR may not discriminate against any employee or applicant for employment because of
OUTER DRIVE & WEST JUNEAU SUPPLEMENTARY GENERAL CONDITIONS
LIFT STATION IMPROVEMENTS
Contract No. BE23-194

SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS

race, religion, color, national origin, age, disability, sex, sexual orientation, gender identity, gender expression, marital status, changes in marital status, pregnancy or parenthood. The CONTRACTOR shall post a notice setting out the provisions of this paragraph in a conspicuous place available to employees and applicants for employment.

The CONTRACTOR and each Subcontractor shall state in all solicitations and advertisements for employees to work on this Project, that it is an Equal Opportunity Employer and that all qualified applicants will receive consideration for employment without regard to race, religion, color, national origin, age, disability, sex, sexual orientation, gender identity, gender expression, marital status, changes in marital status, pregnancy or parenthood.

The CONTRACTOR shall include the provisions of this EEO article in every contract relating to this Project and shall require the inclusion of these provisions in every agreement entered into for this Project, so that those provisions will be binding upon the CONTRACTOR and each Subcontractor.



Tax Clearance Request Form for Contractors

Date of request: _____

Business name of the contractor a Tax Clearance is being requested for: _____

Business address: _____

Business contact phone number: _____

Federal Identification Number: _____

Alaska Employer Account Number: _____

Specific time period a tax clearance is being requested for (i.e. beginning and ending date of a subcontract agreement): _____

Subcontract project name: _____

Name and address of the person this Tax Clearance is to be returned to: _____

Comments or additional information: _____

For agency use only:

- checkbox Tax Clearance is granted
checkbox Tax Clearance is not granted (please have employer contact the department)
checkbox No account on file, liability unknown (please have employer contact the department)
checkbox Employer has stated no employees, Tax Clearance not required.

Agency representative signature: _____ Date: _____

Agency representative title: _____

We are an equal opportunity employer/program. Auxiliary aids and services are available upon request to individuals with disabilities. labor.alaska.gov/estax

**SECTION 00830 - ALASKA LABOR STANDARDS, REPORTING, AND
PREVAILING WAGE RATE DETERMINATION**

State of Alaska, Department of Labor, Laborers' and Mechanics' Minimum Rates of Pay, AS 36.05.010 and AS 36.05.050, Wage and Hour Administration Pamphlet No. 600, the latest edition published by the State of Alaska, Department of Labor inclusive, is provided in its entirety in SECTION 00830 – APPENDIX A.

The rates that are in effect 10 days prior to the final date for submission of bids are the rates that will apply to this project. These rates will apply for 24 calendar months from the date the project is awarded to a prime contractor. At the end of the initial 24-month period, the latest wage rates issued by the Alaska Department of Labor shall become effective for the next 24-month period. This process repeats itself until the project is completed.

The CONTRACTOR is responsible for contacting the Alaska Department of Labor to determine compliance with current regulations.

Correspondence regarding Title 36 requirements may be submitted to ADOL electronically or paper copies can be submitted by mail. To submit Title 36 documents and certified payrolls electronically, go to <https://myalaska.state.ak.us/home/app>.

The CONTRACTOR and each Subcontractor shall submit Certified Payrolls to the CBJ Contract Administrator upon request. If the requested Certified Payrolls are not received by the Contract Administrator within five (5) working days, the Contract Administrator will request the Certified Payrolls from ADOL. The CONTRACTOR shall be responsible for all costs charged by ADOL for delivery of the requested Certified Payrolls, including those costs for Subcontractors.

Within 10 Days of "Notice of Award/Notice to Proceed" make a list of **all** Subcontractors. Include their name, address, phone, estimated subcontract amount, and estimated start and finish dates. Send this list to the Wage and Hour Section (contact information below).

Certified Payrolls must be submitted every two weeks. Before the second Friday, each CONTRACTOR and Subcontractor must file Certified Payrolls with Statements of Compliance for the previous two weeks. Indicate **"Start"** on your first payroll, and **"Final"** on your last payroll for this Project.

As part of the **final payment request package**, CONTRACTOR must submit a "NOTICE OF COMPLETION OF PUBLIC WORKS" form signed by ADOL personnel.

Contact Information:

Wage and Hour Section
State of Alaska
Department of Labor and Workforce Development
Labor Standards and Safety Division and
Wage and Hour Administration
P.O. Box 11149
Juneau, AK 99811-1149
907-465-4842
<http://labor.state.ak.us/lss/home.htm>

Greg Smith, Contract Administrator
City and Borough of Juneau
155 S. Seward Street
Juneau, AK 99801
(907) 586-0800 ext. 4196
greg.smith@juneau.gov


SECTION 00830

APPENDIX A

Laborers' & Mechanics'
Minimum Rates of Pay

Pamphlet 600

Effective September 1, 2022



MINIMUM RATES OF PAY For Laborers and Mechanics

Effective September 1, 2022

Issue 45

PAMPHLET No. 600

Title 36. Public Contracts
AS 36.05

**DEPARTMENT OF LABOR
AND WORKFORCE DEVELOPMENT**

Wage and Hour

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THE STATE
of **ALASKA**
GOVERNOR MIKE DUNLEAVY

Department of Labor and Workforce Development

Office of the Commissioner

Post Office Box 111149
Juneau, Alaska 99811
Main: 907.465.2700
fax: 907.465-2784

September 1, 2022

TO ALL CONTRACTING AGENCIES:

At the Alaska Department of Labor and Workforce Development our goal is putting Alaskans to work. This pamphlet is designed to help contractors awarded public construction contracts understand the most significant laws of the State of Alaska pertaining to prevailing wage.

This pamphlet identifies current prevailing wage rates for public construction contracts (any construction projects awarded for the State of Alaska or its political subdivisions, such as local governments and certain non-profit organizations). Because these rates may change in a subsequent determination, please be sure you are using the appropriate rates. The rates published in this edition become effective September 1, 2022.

The prevailing wage rates contained in this pamphlet are applicable to public construction projects with a final bid date of September 11, 2022, or later. As the law now provides, these rates will remain stable during the life of a contract or for 24 calendar months, whichever is shorter. **The 24-month period begins on the date the prime contract is awarded.** Upon expiration of the initial 24-month period, the latest wage rates issued by the department shall become effective for a subsequent 24-month period or until the original contract is completed, whichever occurs first. This process shall be repeated until the original contract is completed.

The term "original contract" means the signed contract that resulted from the original bid and any amendments, including changes of work scope, additions, extensions, change orders, and other instruments agreed to by the parties that have not been subject to subsequent open bid procedures.

If a higher federal rate is required due to partial federal funding or other federal participation, the higher rate must be paid.

For additional copies of this pamphlet go to: <http://labor.state.ak.us/lss/pamp600.htm>

For questions regarding prevailing wage or employment preference requirements, please contact the nearest Wage and Hour office. These offices are listed on Page x.

Sincerely,

A handwritten signature in black ink that reads "Tamika L. Ledbetter".

Dr. Tamika L. Ledbetter
Commissioner

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Note to Readers: The statutes and administrative regulations listed in this publication were taken from the official codes, as of the effective date of the publication. However, there may be errors or omissions that have not been identified and changes that occurred after the publication was printed. This publication is intended as an informational guide only and is not intended to serve as a precise statement of the statutes and regulations of the State of Alaska. To be certain of current laws and regulations, please refer to the official codes.

EXCERPTS FROM ALASKA LAW

Sec. 36.05.005. Applicability.

This chapter applies only to a public construction contract that exceeds \$25,000.

Sec. 36.05.010. Wage rates on public construction.

A contractor or subcontractor who performs work on a public construction contract in the state shall pay not less than the current prevailing rate of wages for work of a similar nature in the region in which the work is done. The current prevailing rate of wages is that contained in the latest determination of prevailing rate of wages issued by the Department of Labor and Workforce Development at least 10 days before the final date for submission of bids for the contract. The rate shall remain in effect for the life of the contract or for 24 calendar months, whichever is shorter. At the end of the initial 24-month period, if new wage determinations have been issued by the department, the latest wage determination shall become effective for the next 24-month period or until the contract is completed, whichever occurs first. This process shall be repeated until the contract is completed.

Sec. 36.05.040. Filing schedule of employees, wages paid, and other information.

All contractors or subcontractors who perform work on a public construction contract for the state or for a political subdivision of the state shall, before the Friday of every second week, file with the Department of Labor and Workforce Development a sworn affidavit for the previous reporting period, setting out in detail the number of persons employed, wages paid, job classification of each employee, hours worked each day and week, and other information on a form provided by the Department of Labor and Workforce Development.

Sec. 36.05.045. Notice of work and completion; withholding of payment.

- (a) Before commencing work on a public construction contract, the person entering into the contract with a contracting agency shall designate a primary contractor for purposes of this section. Before work commences, the primary contractor shall file a notice of work with the Department of Labor and Workforce Development. The notice of work must list work to be performed under the public construction contract by each contractor who will perform any portion of work on the contract and the contract price being paid to each contractor. The primary contractor shall pay all filing fees for each contractor performing work on the contract, including a filing fee based on the contract price being paid for work performed by the primary contractor's employees. The filing fee payable shall be the sum of all fees calculated for each contractor. The filing fee shall be one percent of each contractor's contract price. The total filing fee payable by the primary contractor under this subsection may not exceed \$5,000. In this subsection, "contractor" means an employer who is using employees to perform work on the public construction contract under the contract or a subcontract.
- (b) Upon completion of all work on the public construction contract, the primary contractor shall file with the Department of Labor and Workforce Development a notice of completion together with payment of any additional filing fees owed due to increased contract amounts. Within 30 days after the department's receipt of the primary contractor's notice of completion, the department shall inform the contracting agency of the amount, if any, to be withheld from the final payment.
- (c) A contracting agency
 - (1) may release final payment of a public construction contract to the extent that the agency has received verification from the Department of Labor and Workforce Development that
 - (A) the primary contractor has complied with (a) and (b) of this section;
 - (B) the Department of Labor and Workforce Development is not conducting an investigation under this title; and
 - (C) the Department of Labor and Workforce Development has not issued a notice of a violation of this chapter to the primary contractor or any other contractors working on the public construction contract; and

- (2) shall withhold from the final payment an amount sufficient to pay the department's estimate of what may be needed to compensate the employees of any contractors under investigation on this construction contract, and any unpaid filing fees.
- (d) The notice and filing fee required under (a) of this section may be filed after work has begun if
 - (1) The public construction contract is for work undertaken in immediate response to an emergency; and
 - (2) The notice and fees are filed not later than 14 days after the work has begun.
- (e) A false statement made on a notice required by this section is punishable under AS 11.56.210.

Sec. 36.05.060. Penalty for violation of this chapter.

A contractor who violates this chapter is guilty of a misdemeanor and upon conviction is punishable by a fine of not less than \$100 nor more than \$1,000, or by imprisonment for not less than 10 days nor more than 90 days, or by both. Each day a violation exists constitutes a separate offense.

Sec. 36.05.070. Wage rates in specifications and contracts for public works.

- (a) The advertised specifications for a public construction contract that requires or involves the employment of mechanics, laborers, or field surveyors must contain a provision stating the minimum wages to be paid various classes of laborers, mechanics, or field surveyors and that the rate of wages shall be adjusted to the wage rate under AS 36.05.010.
- (b) Repealed by §17 ch 142 SLA 1972.
- (c) A public construction contract under (a) of this section must contain provisions that
 - (1) the contractor or subcontractors of the contractor shall pay all employees unconditionally and not less than once a week;
 - (2) wages may not be less than those stated in the advertised specifications, regardless of the contractual relationship between the contractor or subcontractors and laborers, mechanics, or field surveyors;
 - (3) the scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of the work;
 - (4) the state or a political subdivision shall withhold so much of the accrued payments as is necessary to pay to laborers, mechanics, or field surveyors employed by the contractor or subcontractors the difference between
 - (A) the rates of wages required by the contract to be paid laborers, mechanics, or field surveyors on the work; and
 - (B) the rates of wages in fact received by laborers, mechanics, or field surveyors.

Sec. 36.05.080. Failure to pay agreed wages.

Every contract within the scope of AS 36.05.070 shall contain a provision that if it is found that a laborer, mechanic, or field surveyor employed by the contractor or subcontractor has been or is being paid a rate of wages less than the rate of wages required by the contract to be paid, the state or its political subdivision may, by written notice to the contractor, terminate the contractor's right to proceed with the work or the part of the work for which there is a failure to pay the required wages and to prosecute the work to completion by contract or otherwise, and the contractor and the contractor's sureties are liable to the state or its political subdivision for excess costs for completing the work.

Sec. 36.05.090. Payment of wages from withheld payments and listing contractors who violate contracts.

- (a) The state disbursing officer in the case of a state public construction contract and the local fiscal officer in the case of a political subdivision public construction contract shall pay directly to laborers, mechanics, or field surveyors from accrued payments withheld under the terms of the contract the wages due laborers, mechanics, or field surveyors under AS 36.05.070.
- (b) The state disbursing officer or the local fiscal officer shall distribute to all departments of the state government and to all political subdivisions of the state a list giving the names of persons who have disregarded their obligations to employees. A person appearing on this list and a firm, corporation, partnership, or association in which the person has an interest may not work as a contractor or

subcontractor on a public construction contract for the state or a political subdivision of the state until three years after the date of publication of the list. If the accrued payments withheld under the contract are insufficient to reimburse all the laborers, mechanics, or field surveyors with respect to whom there has been a failure to pay the wages required under AS 36.05.070, the laborers, mechanics, or field surveyors have the right of action or intervention or both against the contractor and the contractor's sureties conferred by law upon persons furnishing labor or materials, and in the proceedings it is not a defense that the laborers, mechanics, or field surveyors accepted or agreed to accept less than the required rate of wages or voluntarily made refunds.

Sec. 36.05.900. Definition.

In this chapter, "contracting agency" means the state or a political subdivision of the state that has entered into a public construction contract with a contractor.

EXCERPTS FROM ALASKA ADMINISTRATIVE CODE

*****Notice:** Regulations relating to board and lodging and per diem went into effect on November 25, 2018. The new regulations are excerpted here***

8 AAC 30.051. Purpose. The purpose of 8 AAC 30.052 – 8 AAC 30.056 is to ensure that wages paid to laborers, mechanics, and field surveyors do not fall below the prevailing rate of pay.

8 AAC 30.052. Board and lodging; remote sites. (a) A contractor on a public construction project located 65 or more road miles from the international airport closest to the project area in either Fairbanks, Juneau, or Anchorage, or that is inaccessible by road in a two-wheel drive vehicle, shall provide adequate board and lodging to each laborer, mechanic, or field surveyor while the person is employed on the project. If commercial lodging facilities are not available, the contractor shall provide temporary lodging facilities. Lodging facilities must comply with all applicable state and federal laws. For a highway project, the location of the project is measured from the midpoint of the project.

(b) A contractor is not required to provide board and lodging:

(1) to a laborer, mechanic, or field surveyor who is a domiciled resident of the project area; or

(2) on a laborer, mechanic, or field surveyor's scheduled days off, when the person can reasonably travel between the project and the person's permanent residence; for the purposes of this paragraph, "scheduled day off" means a day in which a person does not perform work on-site, is not required to remain at or near the job location for the benefit of the contractor, and is informed of the day off at least seven days before the day off.

(c) Upon a contractor's written request, the commissioner may waive the requirements of (a) of this section where:

(1) the project is inaccessible by road in a two-wheel drive vehicle, but the laborer, mechanic, or field surveyor can reasonably travel between the project and the person's permanent residence within one hour; or

(2) a laborer, mechanic, or field surveyor is not a domiciled resident of the project area, but has established permanent residence, with the intent to remain indefinitely, within 65 road miles of the project, or for a highway project, the mid-point of the project.

8 AAC 30.054. Per diem instead of board and lodging. (a) A contractor may pay a laborer, mechanic, or field surveyor per diem instead of providing board and lodging, when the following conditions are met:

(1) the department determines that per diem instead of board and lodging is an established practice for the work classification; the department shall publish and periodically revise its determinations in the pamphlet *Laborers and Mechanics Minimum Rates of Pay*;

(2) the contractor pays each laborer, mechanic, or field surveyor the appropriate per diem rate as published and periodically revised in the pamphlet *Laborers and Mechanics Minimum Rates of Pay*; and

(3) the contractor pays the per diem to each laborer, mechanic, or field surveyor on the same day that wages are paid.

(b) A contractor may not pay per diem instead of board and lodging on a highway project located

- (1) west of Livengood on the Elliot Highway, AK-2;
- (2) on the Dalton Highway, AK-11;
- (3) north of milepost 20 on the Taylor Highway, AK-5;
- (4) east of Chicken on the Top of the World Highway; or
- (5) south of Tetlin Junction to the Alaska-Canada border on the Alaska Highway, AK-2.

8 AAC 30.056. Alternative arrangement. Upon a contractor’s written request, the commissioner may approve an alternative board and lodging or per diem arrangement, provided

- (1) the arrangement does not reduce the laborer, mechanic, or field surveyor’s wages below the prevailing wage rate; and
- (2) the laborer, mechanic, or field surveyor voluntarily enters into and signs the written arrangement; a labor organization representing laborers, mechanics, or field surveyors may enter into the written agreement on their behalf.

8 AAC 30.900. General definitions (selected excerpts only):

In this chapter and in AS 36

(22) “domiciled resident” means a person living within 65 road miles of a public construction project, or in the case of a highway project, the mid-point of the project, for at least 12 consecutive months prior to the award of the public construction project;

(23) “employed on the project” means the time period from the date the laborer, mechanic, or field surveyor first reports on-site to the project through the final date the person reports on-site to the project.

ADDITIONAL INFORMATION

PER DIEM

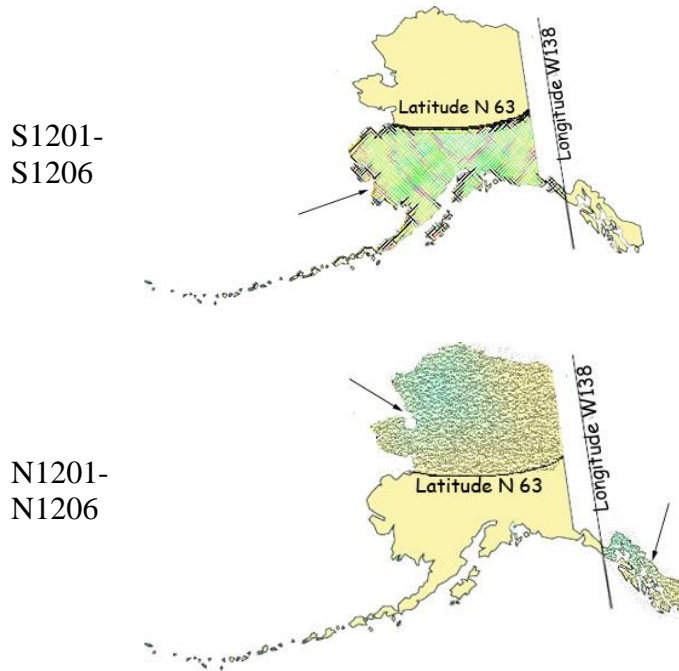
Notice: New regulations relating to board and lodging and per diem went into effect on November 25, 2018. The regulations provide a comprehensive set of requirements for the provision of board and lodging or per diem for workers on remote projects. Please refer to Alaska Administrative Code 8 AAC Chapter 30 and read the chapter carefully.

The Alaska Department of Labor and Workforce Development has determined that per diem is an established work practice for certain work classifications. These classifications are indicated throughout the Pamphlet by an asterisk (*) under the classification title. If all of the conditions of 8 AAC 30.054 are met, an employer may pay workers in these classifications per diem instead of providing board and lodging on a remote project.

Per Diem Rate: As of May 1st, 2019, the minimum per diem rate is \$100.00 per day, or part thereof, the worker is employed on the project. In the event that a contractor provides lodging facilities, but no meals, the department will accept a payment of \$48 per day for meals to meet the per diem requirements.

LABORER CLASSIFICATION CLARIFICATION

The laborer rates categorized in class code S1201-S1206 apply in one area of Alaska; the area that is south of N63 latitude and west of W138 Longitude. The laborer rates categorized in class code N1201-N1206 apply in two areas of Alaska; the Alaska areas north of N63 latitude and east of W138 longitude. The following graphic representations should assist with clarifying the applicable wage rate categories:



APPRENTICE RATES

Apprentice rates at less than the minimum prevailing rates may be paid to apprentices according to an apprentice program which has been registered and approved by the Commissioner of the Alaska Department of Labor and Workforce Development in writing or according to a bona fide apprenticeship program registered with the U.S. Department of Labor, Office of Apprenticeship Training. **Any employee listed on a payroll at an apprentice wage rate who is not registered as above shall be paid the journeyman prevailing minimum wage in that work classification.** Wage rates are based on prevailing crew makeup practices in Alaska and apply to work performed regardless of either the quality of the work performed by the employee or the titles or classifications which may be assigned to individual employees.

FRINGE BENEFIT PLANS

Contractors/subcontractors may compensate fringe benefits to their employees in any one of three methods. The fringe benefits may be paid into a union trust fund, into an approved benefit plan, or paid directly on the paycheck as gross wages.

Where fringe benefits are paid into approved plans, funds, or programs including union trust funds, the payments must be contributed at least monthly. If contractors submit their own payroll forms and are paying fringe benefits into approved plans, funds, or programs, the employer’s certification must include, in addition to those requirements of 8 AAC 30.020(c), a statement that fringe benefit payments have been or will be paid at least monthly. Contractors who pay fringe benefits to a plan must ensure the plan is one approved by the Internal Revenue Service and that the plan meets the requirements of 8 AAC 30.025 (eff. 3/2/08) in order for payments to be credited toward the prevailing wage obligation.

SPECIAL PREVAILING WAGE RATE DETERMINATION

Special prevailing wage rate determinations may be requested for special projects or a special worker classification if the work to be performed does not conform to traditional public construction for which a prevailing wage rate has been established under 8 AAC 30.050(a) of this section. Requests for special wage rate determinations must be in writing and filed with the Commissioner at least 30 days before the award of the contract. An applicant for a special wage rate determination shall have the responsibility to support the necessity for the special rate. An application for a special wage rate determination filed under this section must contain:

- (1) a specification of the contract or project on which the special rates will apply and a description of the work to be performed;
- (2) a brief narrative explaining why special wage rates are necessary;
- (3) the job class or classes involved;
- (4) the special wage rates the applicant is requesting, including survey or other relevant wage data to support the requested rates;
- (5) the approximate number of employees who would be affected; and
- (6) any other information which might be helpful in determining if special wage rates are appropriate.

Requests made pursuant to the above should be addressed to:

Director
Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division
Wage and Hour
P.O. Box 111149
Juneau, AK 99811-1149
-or-
Email: statewide.wagehour@alaska.gov

EMPLOYMENT PREFERENCE INFORMATION

In October 2019, the Alaska Attorney General issued a formal opinion stating that the Alaska Statutes 36.10.150 of the State’s 90% Employment Preference law, also known as the Alaska Resident Hire law, violates both the U.S. and Alaska Constitutions. As a result, the state has stopped all enforcement activity. A copy of the Attorney General opinion is found here:

http://law.alaska.gov/pdf/opinions/opinions_2019/19-005_AK-hire.pdf

Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division
Wage and Hour
Web site: <http://labor.state.ak.us/lss/pamp600.htm>

Anchorage

1251 Muldoon Road, Suite 113
Anchorage, Alaska 99504-2098
Phone: (907) 269-4900

Email:
statewide.wagehour@alaska.gov

Juneau

PO Box 111149
Juneau, Alaska 99811
Phone: (907) 465-4842

Email:
statewide.wagehour@alaska.gov

Fairbanks

Regional State Office Building
675 7th Ave., Station J-1
Fairbanks, Alaska 99701-4593
Phone: (907) 451-2886

Email:
statewide.wagehour@alaska.gov

LABOR STANDARDS AND SAFETY NOTICE REQUESTS

If you would like to receive Wage and Hour or Mechanical Inspection **regulation notices** or **publications information**, they are available via electronic mail, by signing up in the GovDelivery System, <https://public.govdelivery.com/accounts/AKDOL/subscriber/new> and selecting topics *LSS – Wage and Hour – Forms and Publications*, *LSS – Mechanical Inspection Regulations*, or *LSS – Wage and Hour Regulations*.

Publications are also available online at <http://labor.alaska.gov/lss/home.htm>

DEBARMENT LIST

AS 36.05.090(b) states that “the state disbursing officer or the local fiscal officer shall distribute to all departments of the state government and to all political subdivisions of the state a list giving the names of persons who have disregarded their obligations to employees.”

A person appearing on the following debarment list and a firm, corporation, partnership, or association in which the person has an interest may not work as a contractor or subcontractor on a public construction contract for the state or a political subdivision of the state for three years from the date of debarment.

Company Name

Debarment Expires

No companies are currently debarred.

Laborers' & Mechanics' Minimum Rates of Pay

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Boilermakers

*See per diem note on last page

A0101	Boilermaker (journeyman)	46.97	8.57	18.08	1.90	VAC	SAF	80.11
						4.25	0.34	

Bricklayers & Blocklayers

*See per diem note on last page

A0201	Blocklayer	42.01	9.00	10.20	0.62	L&M		62.03
						0.20		

Bricklayer
 Marble or Stone Mason
 Refractory Worker (Firebrick, Plastic, Castable, and Gunitite Refractory Applications)
 Terrazzo Worker
 Tile Setter

A0202	Tuck Pointer Caulker	42.01	9.00	10.20	0.62	L&M		62.03
						0.20		

Cleaner (PCC)

A0203	Marble & Tile Finisher	35.84	9.00	10.20	0.62	L&M		55.86
						0.20		

Terrazzo Finisher

A0204	Torginal Applicator	35.84	9.00	10.20	0.62	L&M		55.86
						0.20		

Carpenters, Region I (North of 63 latitude)

*See per diem note on last page

N0301	Carpenter (journeyman)	43.34	10.35	15.82	1.75	L&M	SAF	71.66
						0.20	0.20	

Lather/Drywall/Acoustical

Carpenters, Region II (South of N63 latitude)

*See per diem note on last page

S0301	Carpenter (journeyman)	43.34	10.35	16.36	1.75	L&M	SAF	72.20
						0.20	0.20	

Lather/Drywall/Acoustical

Cement Masons

*See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Cement Masons
 *See per diem note on last page

A0401	Group I, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
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- Application of Sealing Compound
- Application of Underlayment
- Building, General
- Cement Finisher
- Cement Mason (journeyman)
- Concrete
- Concrete Paving
- Concrete Polishing
- Concrete Repair
- Curb & Gutter, Sidewalk
- Curing of All Concrete
- General Concrete Pour Tender
- Grouting & Caulking of Tilt-Up Panels
- Grouting of All Plates
- Patching Concrete
- Screed Pin Setter
- Screeder or Rodder
- Spackling/Skim Coating

A0402	Group II, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
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- Form Setter

A0403	Group III, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
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- Concrete Saw Cutter Operator (All Control Joints and Self-powered)
- Curb & Gutter Machine
- Floor Grinder
- Pneumatic Power Tools
- Power Chipping & Bushing
- Sand Blasting Architectural Finish
- Screed & Rodding Machine Operator
- Troweling Machine Operator (all concrete surfaces)

A0404	Group IV, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
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- Acoustical or Imitation Acoustical Finish
- Application of All Composition Mastic
- Application of All Epoxy Material
- Application of All Plastic Material
- Finish Colored Concrete
- Gunite Nozzleman
- Hand Powered Grinder

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Cement Masons
*See per diem note on last page

A0404	Group IV, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
	Preparing, scratching and browsing of all ceilings and walls, finished with terrazo or tile							
	Tunnel Worker							

A0405	Group V, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
	Casting and finishing							
	EIFS Systems							
	Finishing of all interior and exterior plastering							
	Fireproofing (Pryocrete, Cafco, Albi-Clad, sprayed fiberglass)							
	Gypsum, Portland Cement							
	Kindred material and products							
	Operation and control of all types of plastering machines, including power tools and floats, used by the industry							
	Overcoating and maintenance of interior/exterior plaster surfaces							
	Plasterer							
	Veneer plastering process (Rapid Plaster, U.S.G. "Imperial Systems", and Pabcoat Systems")							
	Venetian plaster and color-integrated Italian/Middle-Eastern line plaster							

Culinary Workers

A0501	Baker/Cook	29.12	7.31	8.68			LEG	45.11
A0503	General Helper	25.82	7.31	8.68			LEG	41.81
	Housekeeper							
	Janitor							
	Kitchen Helper							
A0504	Head Cook	29.72	7.31	8.68			LEG	45.71
A0505	Head Housekeeper	26.20	7.31	8.68			LEG	42.19
	Head Kitchen Help							

Dredgemen
*See per diem note on last page

A0601	Assistant Engineer	42.76	11.05	13.75	1.00		L&M 0.10	0.05	68.71
	Craneman								

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	L&M	Other Benefits	THR
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Dredgemen
*See per diem note on last page

A0601	Assistant Engineer	42.76	11.05	13.75	1.00	0.10	0.05	68.71
	Electrical Generator Operator (primary pump/power barge/dredge)							
	Engineer							
	Welder							
A0602	Assistant Mate (deckhand)	41.60	11.05	13.75	1.00	0.10	0.05	67.55
A0603	Fireman	42.04	11.05	13.75	1.00	0.10	0.05	67.99
A0605	Leverman Clamshell	45.29	11.05	13.75	1.00	0.10	0.05	71.24
A0606	Leverman Hydraulic	43.53	11.05	13.75	1.00	0.10	0.05	69.48
A0607	Mate & Boatman	42.76	11.05	13.75	1.00	0.10	0.05	68.71
A0608	Oiler (dredge)	42.04	11.05	13.75	1.00	0.10	0.05	67.99

Electricians
*See per diem note on last page

A0701	Inside Cable Splicer	42.77	14.23	13.92	0.95	0.20	0.15	72.22
A0702	Inside Journeyman Wireman, including: Technicians (including use of drones in electrical construction)	42.44	14.23	14.16	0.95	0.20	0.15	72.13
A0703	Power Cable Splicer	63.04	14.23	19.08	0.95	0.25	0.15	97.70
A0704	Tele Com Cable Splicer	50.53	14.23	17.17	0.95	0.20	0.15	83.23
A0705	Power Journeyman Lineman, including: Power Equipment Operator Technician (including use of drones in electrical construction)	61.29	14.23	19.03	0.95	0.25	0.15	95.90
A0706	Tele Com Journeyman Lineman, including: Technician (including use of drones in telecommunications construction) Tele Com Equipment Operator	48.78	14.23	17.11	0.95	0.20	0.15	81.42

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
Electricians								
*See per diem note on last page								
A0707	Straight Line Installer - Repairman	48.78	14.23	17.11	0.95	L&M	LEG	81.42
A0708	Powderman	59.29	14.23	18.97	0.95	L&M	LEG	93.84
A0710	Material Handler	26.57	13.92	5.80	0.15	L&M	LEG	46.74
A0712	Tree Trimmer Groundman	29.12	14.23	13.35	0.15	L&M	LEG	57.15
A0713	Journeyman Tree Trimmer	38.05	14.23	13.62	0.15	L&M	LEG	66.35
A0714	Vegetation Control Sprayer	41.60	14.23	13.73	0.15	L&M	LEG	70.01
A0715	Inside Journeyman Communications CO/PBX	41.02	14.23	13.87	0.95	L&M	LEG	70.42
Elevator Workers								
*See per diem note on last page								
A0802	Elevator Constructor	44.21	16.02	20.21	0.65	L&M	VAC	86.59
A0803	Elevator Constructor Mechanic	63.16	16.02	20.21	0.65	L&M	VAC	107.65
Heat & Frost Insulators/Asbestos Workers								
*See per diem note on last page								
A0902	Asbestos Abatement-Mechanical Systems	40.32	9.24	11.12	1.20	IAF	LML	62.07
A0903	Asbestos Abatement/General Demolition All Systems	40.32	9.24	11.12	1.20	IAF	LML	62.07
A0904	Insulator, Group II	40.32	9.24	11.12	1.20	IAF	LML	62.07
A0905	Fire Stop	40.32	9.24	11.12	1.20	IAF	LML	62.07
Ironworkers								
*See per diem note on last page								
A1101	Ironworkers, including:	41.49	9.91	24.95	0.77	L&M	IAF	77.56

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

IronWorkers
 *See per diem note on last page

						L&M	IAF	
A1101	Ironworkers, including:	41.49	9.91	24.95	0.77	0.20	0.24	77.56
	Bender Operators							
	Bridge & Structural							
	Hangar Doors							
	Hollow Metal Doors							
	Industrial Doors							
	Machinery Mover							
	Ornamental							
	Reinforcing							
	Rigger							
	Sheeter							
	Signalman							
	Stage Rigger							
	Toxic Haz-Mat Work							
	Welder							

						L&M	IAF	
A1102	Helicopter	42.49	9.91	24.95	0.77	0.20	0.24	78.56
	Helicopter (used for rigging and setting)							
	Tower (energy producing windmill type towers to include nacelle and blades)							

						L&M	IAF	
A1103	Fence/Barrier Installer	37.99	9.91	24.95	0.77	0.20	0.24	74.06

						L&M	IAF	
A1104	Guard Rail Layout Man	38.73	9.91	24.95	0.77	0.20	0.24	74.80

						L&M	IAF	
A1105	Guard Rail Installer	38.99	9.91	24.95	0.77	0.20	0.24	75.06

Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)
 *See per diem note on last page

						L&M	LEG	
N1201	Group I, including:	33.00	8.95	21.16	1.40	0.20	0.20	64.91
	Asphalt Worker (shovelman, plant crew)							
	Brush Cutter							
	Camp Maintenance Laborer							
	Carpenter Tender or Helper							
	Choke Setter, Hook Tender, Rigger, Signalman							
	Concrete Labor (curb & gutter, chute handler, curing, grouting, screeding)							
	Crusher Plant Laborer							
	Demolition Laborer							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

						L&M	LEG	
N1201	Group I, including:	33.00	8.95	21.16	1.40	0.20	0.20	64.91
	Ditch Digger							
	Dumpman							
	Environmental Laborer (hazard/toxic waste, oil spill)							
	Fence Installer							
	Fire Watch Laborer							
	Flagman							
	Form Stripper							
	General Laborer							
	Guardrail Laborer, Bridge Rail Installer							
	Hydro-seeder Nozzleman							
	Laborer, Building							
	Landscaper or Planter							
	Laying of Mortarless Decorative Block (retaining walls, flowered decorative block 4 feet or less - highway or landscape work)							
	Material Handler							
	Pneumatic or Power Tools							
	Portable or Chemical Toilet Serviceman							
	Pump Man or Mixer Man							
	Railroad Track Laborer							
	Sandblast, Pot Tender							
	Saw Tender							
	Slurry Work							
	Steam Cleaner Operator							
	Steam Point or Water Jet Operator							
	Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)							
	Tank Cleaning							
	Utiliwalk & Utilidor Laborer							
	Watchman (construction projects)							
	Window Cleaner							

						L&M	LEG	
N1202	Group II, including:	34.00	8.95	21.16	1.40	0.20	0.20	65.91
	Burning & Cutting Torch							
	Cement or Lime Dumper or Handler (sack or bulk)							
	Certified Erosion Sediment Control Lead (CESCL Laborer)							
	Choker Splicer							
	Chucktender (wagon, air-track & hydraulic drills)							
	Concrete Laborer (power buggy, concrete saws, pumpcrete nozzleman, vibratorman)							
	Culvert Pipe Laborer							
	Cured Inplace Pipelayer							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)
 *See per diem note on last page

N1202	Group II, including:	34.00	8.95	21.16	1.40	L&M	LEG	65.91
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- Environmental Laborer (asbestos, marine work)
- Floor Preparation, Core Drilling
- Foam Gun or Foam Machine Operator
- Green Cutter (dam work)
- Gunite Operator
- Hod Carrier
- Jackhammer/Chipping Gun or Pavement Breaker
- Laser Instrument Operator
- Laying of Mortarless Decorative Block (retaining walls, flowered decorative block over 4 feet - highway or landscape work)
- Mason Tender & Mud Mixer (sewer work)
- Pilot Car
- Pipelayer Helper
- Plasterer, Bricklayer & Cement Finisher Tender
- Powderman Helper
- Power Saw Operator
- Railroad Switch Layout Laborer
- Sandblaster
- Scaffold Building & Erecting
- Sewer Caulker
- Sewer Plant Maintenance Man
- Thermal Plastic Applicator
- Timber Faller, Chainsaw Operator, Filer
- Timberman

N1203	Group III, including:	34.90	8.95	21.16	1.40	L&M	LEG	66.81
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- Bit Grinder
- Camera/Tool/Video Operator
- Guardrail Machine Operator
- High Rigger & Tree Topper
- High Scaler
- Multiplate
- Plastic Welding
- Slurry Seal Squeegee Man
- Traffic Control Supervisor
- Welding Certified (in connection with laborer's work)

N1204	Group IIIA	38.18	8.95	21.16	1.40	L&M	LEG	70.09
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- Asphalt Raker, Asphalt Belly Dump Lay Down
- Drill Doctor (in the field)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

						L&M	LEG	
N1204	Group IIIA	38.18	8.95	21.16	1.40	0.20	0.20	70.09

- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
- Pioneer Drilling & Drilling Off Tugger (all type drills)
- Pipelayers
- Powderman (Employee Possessor)
- Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)
- Traffic Control Supervisor, DOT Qualified

						L&M	LEG	
N1205	Group IV	22.57	8.95	21.16	1.40	0.20	0.20	54.48

- Final Building Cleanup
- Permanent Yard Worker

						L&M	LEG	
N1206	Group IIIB	41.97	6.24	21.16	1.40	0.20	0.20	71.17

- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)
- Federal Powderman (Responsible Person in Charge)
- Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)
- Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)
- Stake Hopper

Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

						L&M	LEG	
S1201	Group I, including:	33.00	8.95	21.16	1.40	0.20	0.20	64.91

- Asphalt Worker (shovelman, plant crew)
- Brush Cutter
- Camp Maintenance Laborer
- Carpenter Tender or Helper
- Choke Setter, Hook Tender, Rigger, Signalman
- Concrete Labor (curb & gutter, chute handler, curing, grouting, screeding)
- Crusher Plant Laborer
- Demolition Laborer
- Ditch Digger
- Dumpman
- Environmental Laborer (hazard/toxic waste, oil spill)
- Fence Installer
- Fire Watch Laborer
- Flagman

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

						L&M	LEG	
S1201	Group I, including:	33.00	8.95	21.16	1.40	0.20	0.20	64.91

- Form Stripper
- General Laborer
- Guardrail Laborer, Bridge Rail Installer
- Hydro-seeder Nozzleman
- Laborer, Building
- Landscaper or Planter
- Laying of Mortarless Decorative Block (retaining walls, flowered decorative block 4 feet or less - highway or landscape work)
- Material Handler
- Pneumatic or Power Tools
- Portable or Chemical Toilet Serviceman
- Pump Man or Mixer Man
- Railroad Track Laborer
- Sandblast, Pot Tender
- Saw Tender
- Slurry Work
- Steam Cleaner Operator
- Steam Point or Water Jet Operator
- Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)
- Tank Cleaning
- Utiliwalk & Utilidor Laborer
- Watchman (construction projects)
- Window Cleaner

						L&M	LEG	
S1202	Group II, including:	34.00	8.95	21.16	1.40	0.20	0.20	65.91

- Burning & Cutting Torch
- Cement or Lime Dumper or Handler (sack or bulk)
- Certified Erosion Sediment Control Lead (CESCL Laborer)
- Choker Splicer
- Chucktender (wagon, air-track & hydraulic drills)
- Concrete Laborer (power buggy, concrete saws, pumpcrete nozzleman, vibratorman)
- Culvert Pipe Laborer
- Cured Inplace Pipelayer
- Environmental Laborer (asbestos, marine work)
- Floor Preparation, Core Drilling
- Foam Gun or Foam Machine Operator
- Green Cutter (dam work)
- Gunite Operator
- Hod Carrier

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

						L&M	LEG	
S1202	Group II, including:	34.00	8.95	21.16	1.40	0.20	0.20	65.91

- Jackhammer/Chipping Gun or Pavement Breaker
- Laser Instrument Operator
- Laying of Mortarless Decorative Block (retaining walls, flowered decorative block over 4 feet - highway or landscape work)
- Mason Tender & Mud Mixer (sewer work)
- Pilot Car
- Pipelayer Helper
- Plasterer, Bricklayer & Cement Finisher Tender
- Powderman Helper
- Power Saw Operator
- Railroad Switch Layout Laborer
- Sandblaster
- Scaffold Building & Erecting
- Sewer Caulker
- Sewer Plant Maintenance Man
- Thermal Plastic Applicator
- Timber Faller, Chainsaw Operator, Filer
- Timberman

						L&M	LEG	
S1203	Group III, including:	34.90	8.95	21.16	1.40	0.20	0.20	66.81

- Bit Grinder
- Camera/Tool/Video Operator
- Guardrail Machine Operator
- High Rigger & Tree Topper
- High Scaler
- Multiplate
- Plastic Welding
- Slurry Seal Squeegee Man
- Traffic Control Supervisor
- Welding Certified (in connection with laborer's work)

						L&M	LEG	
S1204	Group IIIA	38.18	8.95	21.16	1.40	0.20	0.20	70.09

- Asphalt Raker, Asphalt Belly Dump Lay Down
- Drill Doctor (in the field)
- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
- Pioneer Drilling & Drilling Off Tugger (all type drills)
- Pipelayers
- Powderman (Employee Possessor)
- Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

S1204	Group IIIA	38.18	8.95	21.16	1.40	L&M	LEG	70.09
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Traffic Control Supervisor, DOT Qualified

S1205	Group IV	22.57	8.95	21.16	1.40	L&M	LEG	54.48
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Final Building Cleanup
Permanent Yard Worker

S1206	Group IIIB	41.97	6.24	21.16	1.40	L&M	LEG	71.17
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Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)
Federal Powderman (Responsible Person in Charge)
Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)
Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)
Stake Hopper

Millwrights

*See per diem note on last page

A1251	Millwright (journeyman)	46.48	10.35	12.87	1.10	L&M		71.25
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A1252	Millwright Welder	47.48	10.35	12.87	1.10	L&M		72.25
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Painters, Region I (North of N63 latitude)

*See per diem note on last page

N1301	Group I, including:	36.08	9.27	15.10	1.08	L&M		61.60
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Brush
General Painter
Hand Taping
Hazardous Material Handler
Lead-Based Paint Abatement
Roll

N1302	Group II, including:	36.60	9.27	15.10	1.08	L&M		62.12
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Bridge Painter
Epoxy Applicator
General Drywall Finisher
Hand/Spray Texturing
Industrial Coatings Specialist

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Painters, Region I (North of N63 latitude)
 *See per diem note on last page

N1302	Group II, including:	36.60	9.27	15.10	1.08		L&M 0.07	62.12
	Machine/Automatic Taping							
	Pot Tender							
	Sandblasting							
	Specialty Painter							
	Spray							
	Structural Steel Painter							
	Wallpaper/Vinyl Hanger							

N1304	Group IV, including:	40.74	9.27	18.21	1.05		0.05	69.32
	Glazier							
	Storefront/Automatic Door Mechanic							

N1305	Group V, including:	39.44	9.27	5.00	1.10		0.10	54.91
	Carpet Installer							
	Floor Coverer							
	Heat Weld/Cove Base							
	Linoleum/Soft Tile Installer							

N1306	Group VI, including:	50.44	10.23	5.00	1.10		0.10	66.87
	Traffic Control Striper							

Painters, Region II (South of N63 latitude)
 *See per diem note on last page

S1301	Group I, including :	33.22	9.27	15.95	1.08		L&M 0.07	59.59
	Brush							
	General Painter							
	Hand Taping							
	Hazardous Material Handler							
	Lead-Based Paint Abatement							
	Roll							
	Spray							

S1302	Group II, including :	34.47	9.27	15.95	1.08		L&M 0.07	60.84
	General Drywall Finisher							
	Hand/Spray Texturing							
	Machine/Automatic Taping							
	Wallpaper/Vinyl Hanger							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Painters, Region II (South of N63 latitude)

*See per diem note on last page

						L&M	
S1303	Group III, including :	34.57	9.27	15.95	1.08	0.07	60.94
	Bridge Painter						
	Epoxy Applicator						
	Industrial Coatings Specialist						
	Pot Tender						
	Sandblasting						
	Specialty Painter						
	Structural Steel Painter						
S1304	Group IV, including:	40.95	9.27	17.25	1.08	0.07	68.62
	Glazier						
	Storefront/Automatic Door Mechanic						
S1305	Group V, including:	39.44	9.27	5.00	1.10	0.10	54.91
	Carpet Installer						
	Floor Coverer						
	Heat Weld/Cove Base						
	Linoleum/Soft Tile Installer						
S1306	Group VI, including:	50.44	10.23	5.00	1.10	0.10	66.87
	Traffic Control Striper						

Piledrivers

*See per diem note on last page

						L&M	IAF	
A1401	Piledriver	43.34	10.35	15.82	1.75	0.20	0.20	71.66
	Assistant Dive Tender							
	Carpenter/Piledriver							
	Rigger							
	Sheet Stabber							
	Skiff Operator							
A1402	Piledriver-Welder/Toxic Worker	44.34	10.35	15.82	1.75	0.20	0.20	72.66
A1403	Remotely Operated Vehicle Pilot/Technician	47.65	10.35	15.82	1.75	0.20	0.20	75.97
	Single Atmosphere Suit, Bell or Submersible Pilot							
A1404	Diver (working) **See note on last page	87.45	10.35	15.82	1.75	0.20	0.20	115.77

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Piledrivers
*See per diem note on last page

A1405	Diver (standby) **See note on last page	47.65	10.35	15.82	1.75	L&M	IAF	75.97
A1406	Dive Tender **See note on last page	46.65	10.35	15.82	1.75	L&M	IAF	74.97
A1407	Welder (American Welding Society, Certified Welding Inspector)	48.90	10.35	15.82	1.75	L&M	IAF	77.22

Plumbers, Region I (North of N63 latitude)
*See per diem note on last page

N1501	Journeyman Pipefitter	45.41	11.75	17.45	1.50	L&M	S&L	76.76
	Plumber							
	Welder							

Plumbers, Region II (South of N63 latitude)
*See per diem note on last page

S1501	Journeyman Pipefitter	41.00	11.88	15.27	1.55	L&M		69.90
	Plumber							
	Welder							

Plumbers, Region IIA (1st Judicial District)
*See per diem note on last page

X1501	Journeyman Pipefitter	41.32	13.37	11.75	2.50	L&M		69.18
	Plumber							
	Welder							

Power Equipment Operators
*See per diem note on last page

A1601	Group I, including:	43.53	11.05	13.75	1.00	L&M		69.48
	Asphalt Roller: Breakdown, Intermediate, and Finish							
	Back Filler							
	Barrier Machine (Zipper)							
	Belcrete with Power Pack & similar conveyors							
	Bending Machine							
	Boat Coxswain							
	Bulldozer							
	Cableways, Highlines & Cablecars							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Power Equipment Operators

*See per diem note on last page

	L&M						
A1601 Group I, including:	43.53	11.05	13.75	1.00	0.10	0.05	69.48
Cleaning Machine							
Coating Machine							
Concrete Hydro Blaster							
Cranes (45 tons & under or 150 feet of boom & under (including jib & attachments))							
(a) Hydralifts or Transporters, (all track or truck type)							
(b) Derricks							
(c) Overhead							
Crushers							
Deck Winches, Double Drum							
Ditching or Trenching Machine (16 inch or over)							
Drag Scraper, Yarder, and similar types							
Drilling Machines, Core, Cable, Rotary and Exploration							
Finishing Machine Operator, Concrete Paving, Laser Screed, Sidewalk, Curb & Gutter Machine							
Grade Checker and/or Line and Grade including Drone							
Helicopters							
Hover Craft, Flex Craft, Loadmaster, Air Cushion, All-Terrain Vehicle, Rollagon, Bargecable, Nodwell, & Snow Cat							
Hydro Ax, Feller Buncher & similar							
Hydro Excavation (Vac-Truck and Similar)							
Loaders (2 1/2 yards through 5 yards, including all attachments):							
(a) Forklifts (with telescopic boom & swing attachment)							
(b) Front End & Overhead, (2-1/2 yards through 5 yards)							
(c) Loaders, (with forks or pipe clamp)							
(d) Loaders, (elevating belt type, Euclid & similar types)							
Material Transfer Vehicle (Elevating Grader, Pickup Machine, and similar types)							
Mechanic, Welder, Bodyman, Electrical, Camp & Maintenance Engineer							
Micro Tunneling Machine							
Mixers: Mobile type with hoist combination							
Motor Patrol Grader							
Mucking Machine: Mole, Tunnel Drill, Horizontal/Directional Drill Operator and/or Shield							
Off-Road Hauler (including Articulating and Haul Trucks)							
Operator on Dredges							
Piledriver Engineer, L.B. Foster, Puller or similar paving breaker							
Plant Operator (Asphalt & Concrete)							
Power Plant, Turbine Operator 200 k.w & over (power plants or combination of power units over 300 k.w.)							
Remote Controlled Equipment							
Scraper (through 40 yards)							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Power Equipment Operators								
*See per diem note on last page								

		L&M						
A1601	Group I, including:	43.53	11.05	13.75	1.00	0.10	0.05	69.48
	Service Oiler/Service Engineer							
	Shot Blast Machine							
	Shovels, Backhoes, Excavators with all attachments, and Gradealls (3 yards & under)							
	Sideboom (under 45 tons)							
	Sub Grader (Gurries & similar types)							
	Tack Tractor							
	Truck Mounted Concrete Pump, Conveyor/Tele-belt, & Creter							
	Wate Kote Machine							

		L&M						
A1602	Group IA, including:	45.29	11.05	13.75	1.00	0.10	0.05	71.24
	Camera/Tool/Video Operator (Slipline)							
	Certified Welder, Electrical Mechanic, Camp Maintenance Engineer, Mechanic (over 10,000 hours)							
	Cranes (over 45 tons or 150 feet including jib & attachments)							
	(a) Clamshells & Draglines (over 3 yards)							
	(b) Tower Cranes							
	Licensed Water/Waste Water Treatment Operator							
	Loaders (over 5 yards)							
	Motor Patrol Grader, Dozer, Grade Tractor (finish: when finishing to final grade and/or to hubs, or for asphalt)							
	Power Plants (1000 k.w. & over)							
	Profiler, Reclaimer, and Roto-Mill							
	Quad							
	Scrapers (over 40 yards)							
	Screed							
	Shovels, Backhoes, Excavators with all attachments (over 3 yards)							
	Sidebooms (over 45 tons)							
	Slip Form Paver, C.M.I. & similar types							
	Topside (Asphalt Paver, Slurry machine, Spreaders, and similar types)							

		L&M						
A1603	Group II, including:	42.76	11.05	13.75	1.00	0.10	0.05	68.71
	Boiler - Fireman							
	Cement Hogs & Concrete Pump Operator							
	Conveyors (except those listed in Group I)							
	Hoists on Steel Erection, Towermobiles & Air Tuggers							
	Horizontal/Directional Drill Locator							
	Locomotives, Rod & Geared Engines							
	Mixers							
	Screening, Washing Plant							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Power Equipment Operators
 *See per diem note on last page

							L&M	
A1603	Group II, including:	42.76	11.05	13.75	1.00	0.10	0.05	68.71
	Sideboom (cradling rock drill, regardless of size)							
	Skidder							
	Trenching Machines (under 16 inches)							
	Water/Waste Water Treatment Operator							

							L&M	
A1604	Group III, including:	42.04	11.05	13.75	1.00	0.10	0.05	67.99
	"A" Frame Trucks, Deck Winches							
	Bombardier (tack or tow rig)							
	Boring Machine							
	Brooms, Power (sweeper, elevator, vacuum, or similar)							
	Bump Cutter							
	Compressor							
	Farm Tractor							
	Forklift, Industrial Type							
	Gin Truck or Winch Truck (with poles when used for hoisting)							
	Hoists, Air Tuggers, Elevators							
	Loaders:							
	(a) Elevating-Athey, Barber Greene & similar types							
	(b) Forklifts or Lumber Carrier (on construction job sites)							
	(c) Forklifts, (with tower)							
	(d) Overhead & Front End, (under 2-1/2 yards)							
	Locomotives: Dinkey (air, steam, gas & electric) Speeders							
	Mechanics, Light Duty							
	Oil, Blower Distribution							
	Posthole Digger, Mechanical							
	Pot Fireman (power agitated)							
	Power Plant, Turbine Operator, (under 200 k.w.)							
	Pumps, Water							
	Roller (other than Asphalt)							
	Saws, Concrete							
	Skid Hustler							
	Skid Steer (with all attachments)							
	Stake Hopper							
	Straightening Machine							
	Tow Tractor							

							L&M	
A1605	Group IV, including:	35.83	11.05	13.75	1.00	0.10	0.05	61.78
	Crane Assistant Engineer/Rig Oiler							
	Drill Helper							
	Parts & Equipment Coordinator							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Power Equipment Operators

*See per diem note on last page

		L&M						
A1605	Group IV, including:	35.83	11.05	13.75	1.00	0.10	0.05	61.78
	Spotter							
	Steam Cleaner							
	Swamper (on trenching machines or shovel type equipment)							

Roofers

*See per diem note on last page

		L&M						
A1701	Roofer & Waterproofer	44.62	13.75	3.91	0.81	0.10	0.06	63.25

		L&M						
A1702	Roofer Material Handler	31.23	13.75	3.91	0.81	0.10	0.06	49.86

Sheet Metal Workers, Region I (North of N63 latitude)

*See per diem note on last page

		L&M						
N1801	Sheet Metal Journeyman	49.04	11.85	14.61	1.80	0.12		77.42

- Air Balancing and duct cleaning of HVAC systems
- Brazing, soldering or welding of metals
- Demolition of sheet metal HVAC systems
- Fabrication and installation of exterior wall sheathing, siding, metal roofing, flashing, decking and architectural sheet metal work
- Fabrication and installation of heating, ventilation and air conditioning ducts and equipment
- Fabrication and installation of louvers and hoods
- Fabrication and installation of sheet metal lagging
- Fabrication and installation of stainless steel commercial or industrial food service equipment
- HVAC-R Service Mechanic, servicing and maintaining HVAC-R Systems
- Manufacture, fabrication assembly, installation and alteration of all ferrous and nonferrous metal work
- Metal lavatory partitions
- Preparation of drawings taken from architectural and engineering plans required for fabrication and erection of sheet metal work
- Sheet Metal shelving
- Sheet Metal venting, chimneys and breaching
- Skylight installation

Sheet Metal Workers, Region II (South of N63 latitude)

*See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Sheet Metal Workers, Region II (South of N63 latitude)

*See per diem note on last page

							L&M	
S1801	Sheet Metal Journeyman	45.35	12.23	14.70	1.83	0.43		74.54
	Air Balancing and duct cleaning of HVAC systems							
	Brazing, soldering or welding of metals							
	Demolition of sheet metal HVAC systems							
	Fabrication and installation of exterior wall sheathing, siding, metal roofing, flashing, decking and architectural sheet metal work							
	Fabrication and installation of heating, ventilation and air conditioning ducts and equipment							
	Fabrication and installation of louvers and hoods							
	Fabrication and installation of sheet metal lagging							
	Fabrication and installation of stainless steel commercial or industrial food service equipment							
	HVAC-R Service Mechanic, servicing and maintaining HVAC-R Systems							
	Manufacture, fabrication assembly, installation and alteration of all ferrous and nonferrous metal work							
	Metal lavatory partitions							
	Preparation of drawings taken from architectural and engineering plans required for fabrication and erection of sheet metal work							
	Sheet Metal shelving							
	Sheet Metal venting, chimneys and breaching							
	Skylight installation							

Sprinkler Fitters

*See per diem note on last page

							L&M	
A1901	Sprinkler Fitter	51.51	10.55	18.15	0.52	0.25		80.98

Surveyors

*See per diem note on last page

							L&M	
A2001	Chief of Parties	46.16	12.23	13.64	1.15	0.10		73.28
A2002	Party Chief	44.57	12.23	13.64	1.15	0.10		71.69
A2003	Line & Grade Technician/Office Technician/GPS, Drones	43.97	12.23	13.64	1.15	0.10		71.09
A2004	Associate Party Chief (including Instrument Person & Head Chain Person)/Stake Hop/Grademan	41.85	12.23	13.64	1.15	0.10		68.97

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
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Surveyors
*See per diem note on last page

A2006	Chain Person (for crews with more than 2 people)	37.51	12.23	13.64	1.15	0.10	64.63
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Truck Drivers
*See per diem note on last page

A2101	Group I, including:	42.94	12.23	13.64	1.15	0.10	70.06
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- Air/Sea Traffic Controllers
- Ambulance/Fire Truck Driver (EMT certified)
- Boat Coxswain
- Captains & Pilots (air & water)
- Deltas, Commanders, Rollagons, & similar equipment (when pulling sleds, trailers or similar equipment)
- Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 40 yards up to & including 60 yards
- Helicopter Transporter
- Liquid Vac Truck/Super Vac Truck
- Material Coordinator or Purchasing Agent
- Ready-mix (over 12 yards up to & including 15 yards) (over 15 yards to be negotiated)
- Semi with Double Box Mixer
- Tireman, Heavy Duty/Fueler
- Water Wagon (250 Bbls and above)

A2102	Group 1A including:	44.21	12.23	13.64	1.15	0.10	71.33
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- Dump Trucks (including rockbuggy, side dump, belly dump & trucks with pups) over 60 yards up to & including 100 yards (over 100 yards to be negotiated)
- Jeeps (driver under load)
- Lowboys, including tractor attached trailers & jeeps, up to & including 12 axles (over 12 axles or 150 tons to be negotiated)

A2103	Group II, including:	41.68	12.23	13.64	1.15	0.10	68.80
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- All Deltas, Commanders, Rollagons, & similar equipment
- Batch Trucks (8 yards & up)
- Batch Trucks (up to & including 7 yards)
- Boom Truck/Knuckle Truck (over 5 tons)
- Cacasco Truck/Heat Stress Truck
- Construction and Material Safety Technician
- Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 20 yards up to & including 40 yards
- Gin Pole Truck, Winch Truck, Wrecker (truck mounted "A" frame manufactured rating over 5 tons)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Truck Drivers
 *See per diem note on last page

A2103 Group II, including:	41.68	12.23	13.64	1.15	L&M		0.10	68.80
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- Mechanics
- Oil Distributor Driver
- Partsman
- Ready-mix (up to & including 12 yards)
- Stringing Truck
- Turn-O-Wagon or DW-10 (not self loading)

A2104 Group III, including:	40.86	12.23	13.64	1.15	L&M		0.10	67.98
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- Boom Truck/Knuckle Truck (up to & including 5 tons)
- Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 10 yards up to & including 20 yards
- Expeditor (electrical & pipefitting materials)
- Gin Pole Truck, Winch Truck, Wrecker (truck mounted "A" frame manufactured rating 5 tons & under)
- Greaser - Shop
- Semi or Truck & Trailer
- Thermal Plastic Layout Technician
- Traffic Control Technician
- Trucks/Jeeps (push or pull)

A2105 Group IV, including:	40.28	12.23	13.64	1.15	L&M		0.10	67.40
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- Air Cushion or similar type vehicle
- All Terrain Vehicle
- Buggymobile
- Bull Lift & Fork Lift, Fork Lift with Power Boom & Swing Attachment (over 5 tons)
- Bus Operator (over 30 passengers)
- Cement Spreader, Dry
- Combination Truck-Fuel & Grease
- Compactor (when pulled by rubber tired equipment)
- Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) up to & including 10 yards
- Dumpster
- Expeditor (general)
- Fire Truck/Ambulance Driver
- Flat Beds, Dual Rear Axle
- Foam Distributor Truck Dual Axle
- Front End Loader with Fork
- Grease Truck
- Hydro Seeder, Dual Axle
- Hyster Operators (handling bulk aggregate)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Truck Drivers
 *See per diem note on last page

						L&M	
A2105	Group IV, including:	40.28	12.23	13.64	1.15	0.10	67.40
	Loadmaster (air & water operations)						
	Lumber Carrier						
	Ready-mix, (up to & including 7 yards)						
	Rigger (air/water/oilfield)						
	Tireman, Light Duty						
	Track Truck Equipment						
	Truck Vacuum Sweeper						
	Warehouseperson						
	Water Truck (Below 250 Bbls)						
	Water Truck (straight)						
	Water Wagon, Semi						

						L&M	
A2106	Group V, including:	39.52	12.23	13.64	1.15	0.10	66.64
	Buffer Truck						
	Bull Lifts & Fork Lifts, Fork Lifts with Power Boom & Swing Attachments (up to & including 5 tons)						
	Bus Operator (up to 30 passengers)						
	Farm Type Rubber Tired Tractor (when material handling or pulling wagons on a construction project)						
	Flat Beds, Single Rear Axle						
	Foam Distributor Truck Single Axle						
	Fuel Handler (station/bulk attendant)						
	Gear/Supply Truck						
	Gravel Spreader Box Operator on Truck						
	Hydro Seeders, Single axle						
	Pickups (pilot cars & all light-duty vehicles)						
	Rigger/Swamper						
	Tack Truck						
	Team Drivers (horses, mules, & similar equipment)						

Tunnel Workers, Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)
 *See per diem note on last page

						L&M	LEG	
N2201	Group I, including:	36.30	8.95	21.16	1.40	0.20	0.20	68.21
	Brakeman							
	Mucker							
	Nipper							
	Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)							
	Topman & Bull Gang							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Tunnel Workers, Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)
 *See per diem note on last page

N2201	Group I, including:	36.30	8.95	21.16	1.40	0.20	0.20	68.21
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Tunnel Track Laborer

N2202	Group II, including:	37.40	8.95	21.16	1.40	0.20	0.20	69.31
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- Burning & Cutting Torch
- Certified Erosion Sediment Control Lead (CESCL Laborer)
- Concrete Laborer
- Floor Preparation, Core Drilling
- Jackhammer/Chipping Gun or Pavement Breaker
- Laser Instrument Operator
- Nozzlemen, Pumpcrete or Shotcrete
- Pipelayer Helper

N2203	Group III, including:	38.39	8.95	21.16	1.40	0.20	0.20	70.30
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- Miner
- Retimberman

N2204	Group IIIA, including:	42.00	8.95	21.16	1.40	0.20	0.20	73.91
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- Asphalt Raker, Asphalt Belly Dump Lay Down
- Drill Doctor (in the field)
- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
- Pioneer Drilling & Drilling Off Tugger (all type drills)
- Pipelayer
- Powderman (Employee Possessor)
- Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)
- Traffic Control Supervisor, DOT Qualified

N2206	Group IIIB, including:	46.17	6.24	21.16	1.40	0.20	0.20	75.37
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- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)
- Federal Powderman (Responsible Person in Charge)
- Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)
- Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)
- Stake Hopper

Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude)
 *See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude)
 *See per diem note on last page

						L&M	LEG	
S2201	Group I, including:	36.30	8.95	21.16	1.40	0.20	0.20	68.21

- Brakeman
- Mucker
- Nipper
- Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)
- Topman & Bull Gang
- Tunnel Track Laborer

						L&M	LEG	
S2202	Group II, including:	37.40	8.95	21.16	1.40	0.20	0.20	69.31

- Burning & Cutting Torch
- Certified Erosion Sediment Control Lead (CESCL Laborer)
- Concrete Laborer
- Floor Preparation, Core Drilling
- Jackhammer/Chipping Gun or Pavement Breaker
- Laser Instrument Operator
- Nozzlemen, Pumpcrete or Shotcrete
- Pipelayer Helper

						L&M	LEG	
S2203	Group III, including:	38.39	8.95	21.16	1.40	0.20	0.20	70.30

- Miner
- Retimberman

						L&M	LEG	
S2204	Group IIIA, including:	42.00	8.95	21.16	1.40	0.20	0.20	73.91

- Asphalt Raker, Asphalt Belly Dump Lay Down
- Drill Doctor (in the field)
- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
- Pioneer Drilling & Drilling Off Tugger (all type drills)
- Pipelayer
- Powderman (Employee Possessor)
- Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)
- Traffic Control Supervisor, DOT Qualified

						L&M	LEG	
S2206	Group IIIB, including:	46.17	6.24	21.16	1.40	0.20	0.20	75.37

- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)
- Federal Powderman (Responsible Person in Charge)
- Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)
- Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude)
 *See per diem note on last page

S2206	Group IIIB, including:	46.17	6.24	21.16	1.40		L&M	LEG	
	Stake Hopper						0.20	0.20	75.37

Tunnel Workers, Power Equipment Operators
 *See per diem note on last page

A2207	Group I	47.88	11.05	13.75	1.00		L&M		
							0.10	0.05	73.83
A2208	Group IA	49.82	11.05	13.75	1.00		L&M		
							0.10	0.05	75.77
A2209	Group II	47.04	11.05	13.75	1.00		L&M		
							0.10	0.05	72.99
A2210	Group III	46.24	11.05	13.75	1.00		L&M		
							0.10	0.05	72.19
A2211	Group IV	39.41	11.05	13.75	1.00		L&M		
							0.10	0.05	65.36

* Per diem is an established practice for this classification. This means that per diem is an allowable alternative to board and lodging if all criteria are met. See 8 AAC 30.051-08 AAC 30.056, and the per diem information on page vii of this Pamphlet.

** Work in combination of classifications: Employees working in any combination of classifications within the diving crew (working diver, standby diver, and tender) in a shift are paid in the classification with the highest rate for a minimum of 8 hours per shift.

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Shipyard Rates Addendum

This Addendum was developed to address the specialized industry of shipbuilding/repair in Alaska, as it relates to public works. For the purposes of providing rates for shipyard work the Department is adopting Shipyard rates from the state of Washington (King County). These rates only apply to work done in shipbuilding/repair in Alaska, under a public contract. This addendum will be updated two times a year to coincide with the corresponding Issue of *Laborers and Mechanics MINIMUM RATES OF PAY*.

Class Code	BHR H&W PEN TRN Other Benefits	THR
Shipyard Workers *See total hourly(THR) note below		
A2300	Ship Building/Repair Boilermaker	47.45
A2305	Ship Building/Repair Carpenter	47.35
A2310	Ship Building/Repair Crane Operator	45.06
A2315	Ship Building/Repair Electrician	48.92
A2320	Ship Building/Repair Heat & Frost Insulator	82.02
A2325	Ship Building/Repair Laborer	47.35
A2330	Ship Building/Repair Mechanist	47.35
A2335	Ship Building/Repair Operating Engineer	45.06
A2340	Ship Building/Repair Painter	47.35
A2345	Ship Building/Repair Pipefitter	47.35
A2350	Ship Building/Repair Rigger	47.45
A2355	Ship Building/Repair Sheet Metal	47.35
A2360	Ship Building/Repair Shipwright	47.35
A2365	Ship Building/Repair Warehouse	45.06

*The THR includes the base hourly rate (BHR) and fringe benefits. Employers must pay a BHR and fringe benefit package that adds up to the THR. Fringe benefits included in the THR can be paid to employees in three ways; paid into a union trust fund, into an approved benefit plan, or paid directly on the paycheck as gross wages.

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

SECTION 00852 - PERMITS

PART 1 - GENERAL

1.1 INDEX OF PERMITS

- A. State of Alaska Department of Highways Utility Permit

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

Approval
Recommended: O.L. Bartness Date: June 2, 19 71

Title: Utility Engineer District: Southeastern Control Section No. 331103

The STATE OF ALASKA, acting by and through the DEPARTMENT OF HIGHWAYS, hereinafter called the Department, under the provisions of AS 19.25.010 and AS 19.25.020, grants a Utility Permit to City and Borough of Juneau of Juneau, Alaska hereinafter called the Permittee, permission to construct, install and thereafter perform routine maintenance, use and operate a Sewer Interceptor System

hereinafter called the Facility, located as follows: _____

Within the Rights of Way of the Outer Drive Phase II & Whittier Street Project
No. F-093-1(3) & X-31530 as shown in Utility Agreement. C-31045

across, along or under the Rights of Way of the Department, acquired and utilized in the operation and maintenance of a State Highway, at the aforementioned locations and/or positions, and in strict conformance with plans, specifications and special provisions attached hereto and made a part hereof, and not otherwise.

In accepting this Utility Permit for the Facility the Permittee agrees to comply with the provisions of AS 19.25.010 and 19.25.020; the terms, requirements and regulations as set forth in the Alaska Administrative Code, Title 17 Highways, Chapter 15 - Engineering - Utility Permits, as authorized under the Administrative Procedures Act AS 44.62.010 - 44.62.650 and the policies, directives and orders issued by the Commissioner of the Department.

This Utility Permit is granted under the provisions of the above referenced statutes, Alaska Administrative Code, regulations and requirements, and upon the expressed terms and conditions as are herein below inserted, and should the Permittee violate any of the laws, provisions of the Administrative Code, or the terms and conditions herein contained, or use or attempt to use or modify said Facility for any other or different purpose, than originally authorized, without first obtaining permission from the Department to so do, or fail to comply with any policy, directive or order of the Department issued by the Commissioner under his power of control and supervision of the Department's State Highways for the use and safety of the general public, then the Department, at its option, may immediately revoke this Utility Permit.

The entire cost of construction, installation and routine maintenance operations of the Facility, and any other expenses whatsoever incident thereto, are to be paid for by the Permittee, and said Facility shall comply with all applicable codes and be completed to the satisfaction of the Department.

The Permittee's construction, installation and maintenance operations of the Facility shall be accomplished in such a manner as to in no way interfere with the use, operation and maintenance of the Department's public highway, and be performed with the minimum interference and interruption of traffic upon and along the highway, or as hereinafter provided in the Department's Special provisions, attached hereto and made a part hereof, and shall at all times in no way endanger the general public in its use of the public highway.

Where the Permittee must clear trees, brush and other natural growth in order to construct, install or perform routine maintenance on the Facility within highway Rights of Way, the Permittee agrees to remove all cleared trees, brush and other natural growth within one (1) year after commencement of construction and installation of said Facility and to the satisfaction of the Department. If the removal of cleared trees, brush and other natural growth is not accomplished within said period of one (1) year, unless extended by the Department, the Permittee hereby agrees to reimburse the Department for the actual costs of removal of said cleared trees, brush and other natural growth from the Department's highway Rights of Way.

The Department, in granting this Utility Permit, reserves the right to use, occupy and enjoy its Rights of Way for a public highway and for public highway purposes in such a manner and at such times as it deems necessary, the same as if this instrument had not been executed by the Department. If any such use by the Department shall at any time necessitate any change in location or manner of use of said Facility, or any part thereof, such change or alteration shall be made by the Permittee without any cost or liability to the Department upon written order by the Commissioner of the Department, except as provided in the Administrative Code, and neither the Department nor the State of Alaska shall be liable to the Permittee on account thereof, or on account of any damage growing out of any use which the State of Alaska or the Department, or either of them, may make of its Rights of Way.

On highways originally established as, or converted to, controlled access highways, ingress and egress thereto is limited to the locations as designated by the Department.

The Department shall have the right to at any time revoke this Utility Permit by the giving of not less than thirty (30) days written notice to the Permittee of the expressed cause or causes of revocation in accordance with the provisions of the Administrative Code. The Permittee, upon said notice of revocation, shall promptly, and in the manner directed by the Department, remove each and every part of said Facility from the Department's Rights of Way and leave the same in a condition satisfactory to the Department. Should the Permittee refuse or fail to comply with said written notice of revocation the Department, at the expiration of said written notice, may, without further notice to the Permittee, remove or otherwise dispose of said Facility located within the Department's Rights of Way and the Permittee hereby agrees to reimburse the Department for all cost incurred by the Department in the removal of the said Facility or Facilities.

The State of Alaska and the Department of Highways for the purpose of this Utility Permit, hereby disclaim any representation of implication to the Permittee that it retains any title in any public Rights of Way other than an easement for so much land for roadway purposes as described by the instrument conveying such easement. The Permittee by these presents accepts notice thereof and agrees that any express or damages incurred by the Permittee through abandonment, removal, reconstruction or alteration of any public Highway, or any part thereof, or incurred by said Permittee as a result of this disclaimer shall be borne by said Permittee at no expense whatsoever to the Department or the State of Alaska.

Where the Permittee proposes to locate a Facility upon land obtained by the Department from another governmental agency under the terms and provisions of a Special Use Permit for highway purposes the Permittee shall first obtain a letter of non-objection from the owning governmental agency for the placement of the Facility, which is to be attached hereto and made a part of this Utility Permit.

The Waiver of any breach of any of the terms or conditions of this Utility Permit, or provisions of the Administrative Code, by the Department shall be limited to the act or acts constituting such breach, and shall never be construed as being continuing or a permanent waiver of any such term or condition, unless expressly agreed to in writing by the parties hereto, all of which shall remain in full force and affect as to future acts or happenings, notwithstanding any such individual waiver or any breach thereof.

No official or employee of the Department other than the Commissioner, or the District Highway Engineer, when so delegated by the Commissioner, shall have the authority to waive any term or condition herein contained.

The Permittee shall not assign or transfer any of the rights authorized by this Utility Permit except upon notification to and upon approval by the Department.

This Utility Permit is void from its inception if the Permittee fails to comply with the regulations concerning the use and future use of any lands or Rights of Way acquired with, or reimbursed by Federal-Aid Highway Funds, or that in any manner jeopardize such reimbursement to the Department.

The Permittee shall give the Department not less than ten (10) days prior written notice, unless otherwise agreed to by the parties hereto, of the Permittee's intention to enter upon the Department's Rights of Way for the purpose of constructing and installing a Facility, or for the performance of major maintenance or reconstruction, altering or removal of a Facility, provided, however, that normal routine maintenance is excepted from this provision, and provided further, that in any instance of sudden emergency requiring prompt and immediate action to protect the public safety, or to mitigate damage to private or public property, no notification to the Department will be required for any work reasonably necessary for such action, provided the Permittee shall assume all costs and liability in connection with said work, and shall notify the Department and the Alaska State Troopers of the location of the emergency and extent of work required by the most expeditious means of communication as soon as reasonably possible to do so, and the permittee shall take such measures as are required to protect the health and safety of the traveling public for the duration of such emergency operations.

The Permittee agrees to forever indemnify the State of Alaska and the Department, or either of them, including its agents and contractors against and save them harmless from all liability for damage to property, or injury to or death of persons, including all costs and expenses incident thereto arising wholly or in part from or in connection with the existence of construction, alteration, maintenance, repair, renewal, reconstruction, operation, use or removal of the said Facility as to pertains to State highway property.

The Utility Permit is issued under the provisions of applicable Alaska Statutes and Administrative Code effective as of the date of execution of this instrument by the Department.

This permit will expire and become null and void unless construction of the facility authorized by this permit is commenced within six (6) months from the date of execution by the District Engineer. The Permittee may request an extension in writing at least fifteen (15) days prior to expiration date of the permit.

The Permittee agrees that the Facility shall be constructed and installed in accordance with the attached:

- a. Plans dated June 2, 1971, Consisting of 15 sheets
- b. Specifications consisting of page _____ through page _____
- c. (Other) _____

which by this reference are made a part hereof, and in accordance with the applicable code pertaining to type facility, and not otherwise, unless prior written authorization is obtained from the Department to so do.

The Permittee in the execution of the Utility Permit agrees to the terms, conditions and stipulations recited in the Special Provisions, prepared by the Department, consisting of page _____ through page _____, which are attached hereto and made a part hereof.

The Permittee agrees to reimburse the Department of Highways for actual costs of inspection and testing as required during the performance of the work proposed by the Permittee. The scope of inspection and testing shall be determined by the District Engineer. The costs billed to the Permittee will be the actual costs of labor and equipment and mileage incurred while performing the inspection and testing.

In consideration of the benefits accruing to the Permittee by reasons of the foregoing agreement, this said agreement is hereby accepted by the Permittee, and the said Permittee hereby agrees to comply with all of the terms, provisions, conditions and stipulations therein contained.

The State of Alaska, acting by and through its Department of Highways, has caused this Utility Permit to be executed on the day and year herein acknowledged below.

Dated this 2nd day of June, 19 71

STATE OF ALASKA
DEPARTMENT OF HIGHWAYS

THE COMPANY OR PERMITTEE

City & Borough of Juneau

Name of Company or Permittee

By Ronald K. Usher

Title Manager

Attest David W. Payne

Title Deputy Clerk

[Signature]
Title Southeastern District Engineer

DEPARTMENT OF HIGHWAYS
ACKNOWLEDGEMENT

STATE OF ALASKA)
JUDICIAL DISTRICT) ss.

BE IT REMEMBERED THAT ON THIS 3rd day of June, 19 71, before me, the undersigned, a Notary Public of the State of Alaska, personally appeared

S. J. Stevens

ACKNOWLEDGEMENT OF COMPANY OR PERMITTEE

STATE OF ALASKA)
JUDICIAL DISTRICT) ss.

BE IT REMEMBERED that on this _____ day of _____, 19____, before me, the undersigned, a Notary Public of the State of Alaska, personally appeared

and _____ both to me personally known and known to me to be the identical individuals named in and who executed the foregoing permit, and acknowledged the said instrument to be the free and voluntary act and deed of the above named company for the uses and purposes therein expressed and on oath stated that they were authorized to execute said instrument.

of the Department of Highways, known to me to be the identical person who executed the foregoing Agreement and he acknowledged to me that he executed the same for and on behalf of the State of Alaska, Department of Highways, with full authority so to do, and for the uses and purposes therein expressed.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Seal of my Office the day and year above written.

MY COMMISSION EXPIRES
MAY 20, 1973

My Commission Expires:
Stanley B. [Signature]
A Notary Public

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Seal of my Office the day and year first above written.

My Commission Expires: My Commission Expires June 9, 1974
David W. Payne
A Notary Public

When applicable or required this Utility Permit has been reviewed and approved:

Chief Utilities Engineer

Federal Highway Administration
Bureau of Public Roads

Date _____, 19 _____

[Signature]
Title for H. G. Tipton, Date JUN 17 1971
Division Engineer

EXHIBIT "B"
CERTIFICATE OF FINDING

Project No.: F93103

Termini: 10th to Main

Utility: The City and Borough of Juneau

Company Contact: City and Borough Engineer

Name: Wayne Trowbridge

Address: 155 S. Seward Street

Location of Records: Cost records will be maintained by the project engineer.

Billing to be on a partial basis.

Type: Installation of sewer interceptor within the right of way of the Outer Drive Project.

Eligibility: This is a new installation, not a replacement facility. Cost of the interceptor, in its entirety, is to be borne by the City and Borough of Juneau. It is not eligible for participation.

Utility's Property Rights: None. The facility is to be located within the right of way under the terms of a utility permit issued by the Department.

Betterments: None

Expired Service Life: None

Scope of Work:

Install sewer interceptor in conformance with Exhibit "C", which consists of plans and specifications prepared by the consulting firm of CH2M Hill for the City and Borough of Juneau.

Prepared by *[Signature]*

Date 6-2-71

Verified by *[Signature]*

Date 6-2-71

Approved by *Ronald L. Usher*

Utility City and Borough of Juneau

Date June 4, 1971

SECTION 00853 - STANDARD DETAILS

PART 1 - GENERAL

1.1 STANDARD DETAILS

- A. Whenever references are made to the Standard Drawings or Standard Details in these plans or Specifications the intent is to refer to the current City and Borough of Juneau Standard Details (currently the 4th Edition dated August 2011), copies of which may be purchased from the CBJ Engineering Department.
- B. City and Borough of Juneau Standard Details which specifically apply to this Project include but are not limited to the following:

LIST OF DETAILS

<u>STANDARD DETAIL NO.</u>	<u>NAME OF DETAIL</u>
220-03	Pump Station Details

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

**OUTER DRIVE & WEST JUNEAU
LIFT STATIONS IMPROVEMENTS
CONTRACT NO. BE23-194**

**CONSTRUCTION SPECIFICATIONS
BID DOCUMENTS**

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CONSTRUCTION SPECIFICATIONS – TABLE OF CONTENTS

Section No.	Section Title
000	Spec Cover
01 00 00	Table of Contents
01 02 50	Measurement and Payment
01 10 00	Summary of Work
01 11 20	Special Provisions
01 51 37	Bypass Pumping
02 41 00	Demolition
03 01 00	Maintenance of Concrete
05 50 00	Metal Fabrications
08 11 13	Hollow Metal Doors and Frames
08 31 13	Access Hatches and Frames
08 71 00	Door Hardware
09 97 00	Special Coatings
22 05 00	Common Work Results for Plumbing
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 00	Plumbing Insulation
22 11 00	Facility Water Distribution
22 11 19	Piping and Tubing Systems
22 13 00	Facility Sanitary Sewerage
22 14 29	Sump Pumps
22 33 00	Electric Domestic Water Heaters
23 05 93	Testing, Adjusting, and Balancing for HVAC
23 31 00	HVAC Ducts and Casings
23 34 00	HVAC Fans
23 37 00	Air Outlets and Inlets
23 82 39	Unit Heaters
25 14 05	Electrical Automation and Terminal Devices
26 01 26	Electrical Tests
26 05 00	Electrical Work, General
26 05 19	Wire and Cables
26 05 26	Grounding
26 05 33	Electrical Raceway Systems
26 22 00.05	Dry Type Transformers
26 24 16.05	Panel Boards
26 24 19	Low Voltage Motor Control Centers
26 28 16	Enclosed Switches and Circuit Breakers
26 29 23	Variable Frequency Drive Units

CONSTRUCTION SPECIFICATIONS – TABLE OF CONTENTS

26 36 23	Automatic Transfer Switch
26 43 13	Surge Protection for Low Voltage Electrical Power Circuits
33 01 30.72	Rehabilitation by Ultraviolet Light Cured-in-Place Pipe
33 02 30.74	Rehabilitation by Thermal Cured-in-Place Pipe
33 32 20	Dry-Pit Submersible Pumps
40 05 00	Common Work Results for Piping, General
40 05 05	Exposed Pipe Installation
40 05 06	Couplings, Adapters and Specials for Process Piping
40 05 07	Hangers and Supports for Process Piping
40 05 09	Wall Pipes, Floor Pipes and Pipe Sleeves
40 05 19	Ductile Iron Process Pipe and Fittings
40 05 53	Process Valves
40 05 59.33	Cast Iron Slide Gates
40 61 00	Process Control and Instrumentation Systems Commissioning
40 63 00	Control Panels
40 71 00	In-Line Liquid Flow Measuring Systems
40 72 00	Level Measuring Systems
40 73 00	Pressure Measuring Systems
40 74 00	pH and Temperature Measuring Systems
40 75 00	Gas Detectors
41 22 13.24	Mast Type Jib Crane
41 22 23.19	Monorail Chain Hoist

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SCOPE

- a. Payment for the various items of the Bid Schedule, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items for WORK being described, as necessary to complete the various items of the WORK all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA) and Occupational Safety and Health Standards of the Alaska Department of Labor, Division of Labor Standards and Safety.
- b. No separate payment will be made for any Pay Item that is not specifically set forth in the Bid Schedule, and all costs therefore shall be included in the prices named in the Bid Schedule for the various appurtenant items of WORK.
- c. In addition to the other incidental items of WORK listed elsewhere in the contract, the following items shall also be considered as incidental to other items of WORK under this contract:
 - i. Maintenance of all services through the Project area including power, water, storm and sanitary sewers, garbage pickup, mail delivery, and emergency vehicles.
 - ii. Traffic control, including flaggers, and installation and maintenance of traffic control devices in accordance with the Manual of Uniform Traffic Control Devices – Millennium Edition (MUTCD) and the current AKDOT&PF supplements.
 - iii. Lane shift, closure, and/or other traffic control permits required by AKDOT&PF for work within AKDOT&PF Right-of-Way (ROW).
 - iv. Repair or replacement of existing adjacent facilities including piping, landscaping, steel, timber, concrete and asphalt items.
 - v. Final clean-up and site restoration.
 - vi. All WORK necessary for coordination of work to be accomplished by the private utility companies and property owners within the Project limits.
 - vii. Removal and replacement of survey monuments and markers disturbed during construction, whether shown on the Drawings or not.
 - viii. Watering of the roadway as necessary for dust control.
 - ix. All fittings (except CPP and CMP saddle tees) required for storm, water and sanitary sewer pipes.
 - x. All WORK required to notify utility users of pending utility shut-downs.
- d. Pay item numbers are based on corresponding CBJ Standard Specifications or corresponding CSI MasterFormat® division numbers and correlate to those listed on the bid form.
- e. Pay items including decimal 1 (.1) represent work scope for Outer Drive Pump Station, and decimal 2 (.2) represent work scope for West Juneau Pump Station.
- f. Pay items including no decimal represent scope of work applicable to, and inclusive of both Pump Stations.

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

- 1.2 MOBILIZATION (Pay Item No. 01505) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment for Mobilization will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents for BOTH pump stations.
 - b. Payment for Mobilization will be made at the amount shown on the Bid Schedule under Pay Item No. 01505, which payment will constitute full compensation for all WORK described in SECTION 01505 - MOBILIZATION, as shown on the Drawings and as directed by the Engineer.
 - c. Partial payments will be made as the WORK progresses as follows:
 - i. When 5% of the total original contract amount is earned from other Pay Items, 50% of the amount bid for Mobilization, or 5% of the original contract amount, whichever is lesser, will be paid.
 - ii. When 10% of the total original contract amount is earned from other Pay Items, 100% of the amount bid for Mobilization, or 10% of the original contract amount, whichever is lesser, will be paid.
 - iii. Upon completion of all WORK on the Project, payment of any amount bid for Mobilization in excess of 10% of the total contract amount will be paid.
- 1.3 TRAFFIC CONTROL (Pay Item No. 01550) PRICE BASED ON LUMP SUM UNIT
- a. Measurement for payment for Traffic Control will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Traffic Control will be made at the amount shown on the Bid Schedule under Pay Item No. 01550, which payment will constitute full compensation for all WORK described in SECTION 01550 – SITE ACCESS AND STORAGE, as shown on the Drawings, and as directed by the Engineer.
- 1.4 EROSION AND SEDIMENT CONTROL (Pay Item No. 01570) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment for Erosion and Sediment Control will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Erosion and Sediment Control will be made at the amount shown on the Bid Schedule under Pay Item No. 01570, which payment will constitute full compensation for all WORK described in SECTION 01570 – EROSION AND SEDIMENT CONTROL, as shown on the Drawings and as directed by the Engineer.
- 1.5 TRENCHING (Pay Item No. 02203.1) PRICE BASED ON LUMP SUM UNIT
- a. Measurement for payment for Trenching will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

- b. Payment for Trenching will be made at the amount shown on the Bid Schedule under Pay Item No. 02203, which payment will constitute full compensation for all WORK described in SECTION 02203 – TRENCHING, as shown on the Drawings and as directed by the Engineer.
- 1.6 REHABILITATION BY CURED-IN-PLACE PIPE (CIPP) LINING, 30-INCH (Pay Item No. 02401) PRICE BASED ON UNIT PRICE PAY UNIT.
- a. Measurement for payment for Cured-in-Place Pipe Lining will be based upon the completion of the WORK as a Linear Foot Pay Unit, complete, all in accordance with the requirements of the Contract Documents as measured from the interior wall face of the wet well to the interior wall face of the manhole plus allowance for penetration and sealing as shown on the plans.
 - b. Payment for Cured-in-Place Pipe Lining will be made at the amount shown on the Bid Schedule under Pay Item No. 02401, which payment will constitute full compensation for all WORK described in SECTION 330130.72 OR SECTION 330130.73 – REHABILITATION BY UV CURED-IN-PLACE PIPE, OR REHABILITATION BY THERMAL CURED-IN-PLACE PIPE as shown on the Drawings and as directed by the Engineer. Either method will be acceptable.
- 1.7 CONSTRUCTION SURVEYING (Pay Item No. 02702) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Construction Surveying will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Construction Surveying will be made at the amount named in the Bid Schedule under Pay Item No. 02702, which payment will constitute full compensation for all WORK described in SECTION 02702 - CONSTRUCTION SURVEYING, as shown on the Drawings and as directed by the Engineer.
- 1.8 STRUCTURAL CONCRETE (Pay Item No. 03301.1 and No. 03301.2) PRICE BASED ON UNIT PRICE PAY UNIT
- a. Measurement for payment of Structural Concrete will be based upon the completion of the WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Structural Concrete will be made at the amount named in the Bid Schedule under Pay Item No. 03301.1 and 03301.2 which payment will constitute full compensation for all WORK described in SECTION 03301 - STRUCTURAL CONCRETE, SECTION 030100 – MAINTENANCE OF CONCRETE, and as shown on the Drawings and as directed by the Engineer.
- 1.9 BYPASS PUMPING (Pay Item No. 011537.1 and No 011537.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Bypass Pumping will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete all in accordance with the requirements of the Contract Documents.

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

- b. Bypass pumping shall include all materials and equipment, those detailed in the plans and specifications, and those incidental as required to complete the work in a safe manner to ensure continuous sewer service to the upstream sewer basins from the existing Pump Station for the duration of construction.
 - c. Payment for Bypass Pumping will be made at the amount shown in the Bid Schedule under Pay Item No. 011537.1, and No 011537.2 which payment will constitute full compensation for all WORK described in SECTION 011537 – BYPASS PUMPING, as described in the Contract Documents and as directed by the Engineer.
- 1.10 DEMOLITION (Pay Item No. 024100.1 and No. 024100.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment for Demolition will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Demolition includes, but is not limited to, removal and disposal of the existing Outer Drive and West Juneau pumps, control panels, piping to and from the lift station, fittings, brackets, hardware, electrical conduit and conductors, electrical gear and equipment, concrete top slabs, asphalt pavement, and miscellaneous ancillary items as indicated in the Drawings.
 - c. Payment for Demolition of Existing Lift Station will be made at the amount shown on the Bid Schedule under Pay Item No. 024100.1 and No. 021400.2, which payment will constitute full compensation for all WORK described in Section 024100 – DEMOLITION, as shown on the Drawings, and as directed by the Engineer.
- 1.11 MISCELLANEOUS METALS (Pay Item No. 055000.1 and No. 055000.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Miscellaneous Metals will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Miscellaneous Metals will be made at the amount named in the Bid Schedule under Pay Item No. 055000.1 and No. 055000.2, which payment will constitute full compensation for all WORK described in SECTION 055000 – METALS FABRICATIONS, as shown on the Drawings and as directed by the Engineer.
- 1.12 OPENINGS (Pay Item No. 080000.1 and No. 080000.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Openings will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

- b. Payment for Openings will be made at the amount named in the Bid Schedule under Pay Item No. 080000.1 and No. 080000.2, which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
- SECTION 081113 – HOLLOW METAL DOORS AND FRAMES
 - SECTION 083113 – ACCESS HATCHES AND FRAMES
 - SECTION 087100 – DOOR HARDWARE
- 1.13 PLUMBING – (Pay Item No. 220000.1 and No. 220000.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Plumbing will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- b. Payment for Plumbing will be made at the amount named in the Bid Schedule under Pay Item No. 220000.1 and No. 220000.2, which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
- SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING
 - SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
 - SECTION 220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
 - SECTION 220700 – PLUMBING INSULATION
 - SECTION 221100 – FACILITY WATER DISTRIBUTION
 - SECTION 221119 – PIPING AND TUBING SYSTEMS
 - SECTION 221300 – FACILITY SANITARY SEWERAGE
 - SECTION 221429 – SUMP PUMPS
 - SECTION 223300 – ELECTRIC DOMESTIC WATER HEATERS
- 1.14 HEATING, VENTILATION, AND AC SYSTEMS – (Pay Item No. 230000.1 and No. 230000.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Heating, Ventilation, and AC Systems will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- b. Payment for Heating, Ventilation, and AC Systems will be made at the amount named in the Bid Schedule under Pay Item No. 230000.1 and 230000.2, which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
- SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC
 - SECTION 233100 – HVAC DUCTS AND CASINGS
 - SECTION 233400 – HVAC FANS
 - SECTION 233700 – AIR OUTLETS AND INLETS

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

- SECTION 238239 – UNIT HEATERS

1.15 ELECTRICAL IMPROVEMENTS (Pay Item No. 260000.1 and No 260000.2) PRICE BASED ON LUMP SUM PAY UNIT

- a. Measurement for payment of Electrical Improvements will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- b. Payment for Electrical will be made at the amount named in the Bid Schedule under Pay Item No. 260000.1 and No. 260000.2, which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
 - SECTION 260126 – ELECTRICAL TESTS
 - SECTION 260500 – ELECTRICAL WORK, GENERAL
 - SECTION 260519 – WIRE AND CABLES
 - SECTION 260526 – GROUNDING
 - SECTION 260533 – ELECTRICAL RACEWAY SYSTEMS
 - SECTION 262200.05 – DRY TYPE TRANSFORMERS
 - SECTION 262416.05 – PANEL BOARDS
 - SECTION 262419 – LOW VOLTAGE MOTOR CONTROL CENTERS
 - SECTION 262923 – VARIABLE FREQUENCY DRIVE UNITS
 - SECTION 263623 – AUTOMATIC TRANSFER SWITCH
 - SECTION 264313 – SURGE PROTECTION FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

1.16 DRY PIT SUBMERSIBLE PUMPS (Pay Item No. 333220.1 and No. 333220.2) PRICE BASED ON LUMP SUM PAY UNIT

- a. Measurement for payment of Dry Pit Submersible Pumps will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- b. Payment for Dry Pit Submersible Pumps will be made at the amount named in the Bid Schedule under Pay Item No. 333220.1 and No. 333220.2, which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
 - SECTION 333220 – DRY PIT SUBMERSIBLE PUMPS

1.17 PROCESS PIPING, VALVES, AND APPURTENANCES (Pay Item No. 400500.1 and No. 400500.2) PRICE BASED ON LUMP SUM PAY UNIT

- a. Measurement for payment of Process Piping, Valves, and Appurtenances will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- b. Process Piping, Valves, and Appurtenances shall include but not be limited to all wet well and dry well piping to the force main tie-in points including all pipe, valves, fittings,

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

pumps, equipment, supports, drain-pipe, concrete penetrations and seals, nuts, bolts, and other miscellaneous items necessary for a complete installation; all testing, warranties, operation and technical data as required, and WORK necessary for a complete, working and acceptable installation.

- c. Payment for Process Piping, Valves, and Appurtenances will be made at the amount named in the Bid Schedule under Pay Item No. 400500.1, and No. 400500.2, which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
 - SECTION 400505 – EXPOSED PIPE INSTALLATION
 - SECTION 400506 – COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING
 - SECTION 400507 – HANGERS AND SUPPORTS FOR PROCESS PIPING
 - SECTION 400509 – WALL PIPES, FLOOR PIPES, AND PIPE SLEEVES
 - SECTION 400519 – DUCTILE IRON PROCESS PIPE AND FITTINGS
 - SECTION 400553 – PROCESS VALVES
 - SECTION 400559.33 – CAST IRON SLIDE GATES
- 1.18 PROCESS CONTROL AND INSTRUMENTATION (Pay Item No. 406100.1 and No. 406100.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Process Control and Instrumentation will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Process Control and Instrumentation will be made at the amount named in the Bid Schedule under Pay Item No. 406100.1 and No 406100.2, which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
 - SECTION 406100 – PROCESS CONTROL AND INSTRUMENTATION SYSTEMS AND COMMISSIONING
 - SECTION 406300 – CONTROL PANELS
 - SECTION 407100 – IN-LINE LIQUID FLOW MEASURING SYSTEMS
 - SECTION 407200 – LEVEL MEASURING SYSTEMS
 - SECTION 407300 – PRESSURE MEASURING SYSTEMS
 - SECTION 407400 – PH AND TEMPERATURE MEASURING SYSTEMS
 - SECTION 407500 – GAS DETECTORS
- 1.19 PROCESS AND HANDLING EQUIPMENT (Pay Item No. 410000.1 and No. 410000.2) PRICE BASED ON LUMP SUM PAY UNIT
- a. Measurement for payment of Process and Handling Equipment will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - b. Payment for Process and Handling Equipment will be made at the amount named in the Bid Schedule under Pay Item No. 410000.1, and No. 410000.2 which payment will constitute full compensation for all WORK as shown on the Drawings, as directed by the Engineer, and as described in the following sections:
 - SECTION 412213.23 – MOBILE CRANES

SECTION 01 02 50 – MEASUREMENT AND PAYMENT

• SECTION 412223.19 – MONORAIL CHAIN HOIST

1.20 ADDITIVE ALTERNATE (Pay Item No. 333220.1, No 333220.1a, and 333220.2) PRICE
BASED ON UNIT PRICE PAY UNIT

- a. Measurement for payment of Additive Alternate will be based upon the completion of the entire WORK as a Unit Price Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- b. Payment for Additive Alternate will be made at the amount named in the Bid Schedule under Pay Item No. 333220.1, No. 333220.1a, and No. 333220.2, which payment will constitute full compensation for WORK as directed by the Engineer.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01 10 00 SUMMARY OF WORK

PART 1 - GENERAL

1.1 GENERAL

- A. The WORK to be performed under this contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all WORK, or other operations required for the fulfillment of the contract in strict accordance with the Contract Documents. The WORK shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents, including work stipulated in the permits attached to this contract, which may be necessary for the complete and proper construction of the WORK in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the OWNER.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The WORK covered in the Contract Documents includes retrofit of two wastewater lift stations (pump stations) including bypass pumping, cure-in-place pipe lining of 30-inch gravity sewer main, structural concrete modifications, miscellaneous metals fabrication for wastewater facilities, removal and replacement of; ductile iron process piping, sewer slide gates, access hatches and safety grating, metal ladders, miscellaneous process and drain piping, wastewater process valves, dry-pit submersible wastewater pumps, instrumentation, pump power supply and controls, potable water plumbing, HVAC ducting, unit heater and blower system, pump electrical gear, conduit and conductors, water level sensing devices and related equipment. Bypass pumping will be required to maintain wastewater service to the two associated sewer catchment areas, and one or more sewer service lines. Startup, commissioning, and performance optimizing of the two pump stations, and all ancillary work resulting in the functional performance of the pump stations is included.

1.3 CONTRACT METHOD

- A. The WORK, hereunder, will be constructed under a unit-price contract.

1.4 WORK BY OTHERS

- A. The CONTRACTOR's attention is directed to the fact that work may be conducted at the site by other contractors during the performance of the WORK under this contract. The CONTRACTOR shall conduct its operations so as to cause a minimum of interference with the WORK of such other contractors and shall cooperate fully with such contractors to provide continued safe access to their respective portions of the site, as required to perform work under their respective contracts.
- B. Interference With Work On Utilities: The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

SECTION 01 10 00 SUMMARY OF WORK

1.5 CONTRACTOR USE OF PROJECT SITE

- A. The CONTRACTOR's use of the Project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.

1.6 OWNER USE OF THE PROJECT SITE

- A. The OWNER may utilize all or part of the existing site during the entire period of construction for the conduct of the OWNER's normal operations. The CONTRACTOR shall cooperate and coordinate with the ENGINEER to facilitate the OWNER's operations and to minimize interference with the CONTRACTOR's operations at the same time. In any event, the OWNER shall be allowed access to the project site during the period of construction.

1.7 DISPOSAL OF CONSTRUCTION WASTE WATER

- A. Disposal of water used for cleaning, general construction, testing, thermal cure of cure-in-place pipe, and other required waste water, may not be placed in the City's wastewater collection system without prior written approval from the CBJ wastewater plant and Engineer. Provide two working day notice of request for disposal of construction waste water.

1.8 PROJECT MEETINGS

A. Pre-Construction Conference

1. Prior to the commencement of WORK at the site, a Pre-Construction Conference will be held at a mutually agreed time and place which shall be attended by the CONTRACTOR's Project Manager, its superintendent, and its subcontractors as the CONTRACTOR deems appropriate. Other attendees will be:
 - a. ENGINEER and the Inspector.
 - b. Representatives of OWNER.
 - c. Governmental representatives as appropriate.
 - d. Others as requested by CONTRACTOR, OWNER, or ENGINEER.
2. Unless previously submitted to the ENGINEER, the CONTRACTOR shall bring to the Pre-Construction Conference one copy each of the following:
 - a. Plan of Operation.
 - b. Project Overview Bar Chart Schedule.
 - c. Procurement schedule of major equipment and materials and items requiring long lead time.
 - d. Shop Drawing/Sample/Substitute or "Or Equal" submittal schedule.
 - e. Name and telephone number of CONTRACTOR'S Project Supervisor.
3. The purpose of the Pre-Construction Conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date.

SECTION 01 10 00 SUMMARY OF WORK

The CONTRACTOR should be prepared to discuss all of the items listed below:

- a. Status of CONTRACTOR's insurance and bonds.
- b. CONTRACTOR's tentative schedules.
- c. Transmittal, review, and distribution of CONTRACTOR's submittals.
- d. Processing applications for payment.
- e. Maintaining record documents.
- f. Critical work sequencing.
- g. Field decisions and Change Orders.
- h. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
- i. Major equipment deliveries and priorities.
- j. CONTRACTOR's assignments for safety and first aid.
- k. Erosion Control Plan as required by the Alaska Dept. of Transportation and Public Facilities.
- l. Permit requirements of the Alaska Dept. of Transportation and Public Facilities.

4. The OWNER will preside at the Pre-construction Conference and will arrange for keeping and distributing the minutes to all persons in attendance.

B. Progress Meetings

1. The CONTRACTOR shall schedule and hold regular on-site progress meetings at least weekly and at other times as requested by the ENGINEER, or as required by progress of the WORK. The CONTRACTOR, ENGINEER, and all subcontractors active on the site must attend each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other Subcontractors.
2. The ENGINEER shall preside at the meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings will be to review the progress of the WORK, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop. During each meeting, the CONTRACTOR is required to present issues which may impact his work, with a view to resolve these issues expeditiously.

1.9 DEFINITIONS APPLICABLE TO TECHNICAL SPECIFICATIONS

- A. The following words have the meaning defined in the Technical Portions of the WORK:

Furnish - means to supply and deliver to the site, to unload and unpack ready for assembly, installation, testing, and startup.

Indicated - is a word used to direct the CONTRACTOR to information contained on the drawings or in the Specifications. Terms such as "shown," "noted," "scheduled," and "specified" also may be used to assist in locating information but no limitation of location is implied or intended.

Install - defines operations at the site including assembly, erection, placing, anchoring, applying, shaping to dimension, finishing, curing, protecting, and cleaning, ready for the

SECTION 01 10 00 SUMMARY OF WORK

OWNER's use.

Installer - a person or firm engaged by the CONTRACTOR or its subcontract or any subcontractor for the performance of installation, erection, or application work at the site. Installers must be expert in the operations they are engaged to perform.

Provide - is defined as furnish and install, ready for the intended use.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 11 20 – SPECIAL PROVISIONS

The Standard Specifications for Civil Engineering Projects and Subdivision Improvements December 2003 Edition, with fourteen Errata Sheets, as published by the City and Borough of Juneau, is part of these Contract Documents and shall pertain to all phases of the contract. The Standard Specifications for Civil Engineering Projects and Subdivision Improvements December 2003 Edition is available for a fee from the City and Borough of Juneau Engineering Contracts Office, (907) 586-0873, or you may view them online at: <https://beta.juneau.org/engineering-public-works/standard-specifications>.

The construction specifications made part of these Contract Documents include those under Construction Standards Institute (CSI) MasterFormat® naming and number system as listed in the table of contents of these Construction Specifications. These additional specification sections utilizing CSI MasterFormat® are not considered special provisions in the table provided in this Section 01 11 20. Where duplication or conflicting requirements exist between The Standard Specifications for Civil Engineering Projects and Subdivision Improvements December 2003 including Errata, and the CSI specifications provided, the more stringent requirement shall control. The Engineer reserves the right to allow selection of lesser requirement upon review of conflicting requirements. Contractor shall make Engineer aware of any known specification duplication or conflict.

Special Provisions - Table of Contents

Section No.	Section Title
02203	Trenching
02401	Sanitary Sewer Pipe
02702	Construction Surveying

SECTION 01 11 20 – SPECIAL PROVISIONS

SECTION 02203 – TRENCHING, PART 2 - MATERIALS, Article 2.2 BEDDING, *replace paragraph A with the following:*

- A. Pea gravel, or similar product, shall not be used for bedding. Class B bedding material shall be used for all pipe installed on this project

END OF SECTION

SECTION 02401 – SANITARY SEWER PIPE, PART 2 – PRODUCTS, Article 2.4, HDPE PRESSURE PIPE, *replace paragraph A with the following, and delete paragraph C:*

- A. High-Density Polyethylene (HDPE) pipe and fittings are to be manufactured in accordance with AWWA C906 with the additional stipulation that HDPE is to be manufactured from PE4710 polyethylene compounds that meet or exceed ASTM D3350 Cell Classification 445574. HDPE pipe and fitting material compound is to contain color and ultraviolet (UV) stabilizer meeting or exceeding the requirements of Code C per ASTM D3355. All fittings are to have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.
 - 1. All pipe 4” and greater shall be DR11, 200 psi, pressure rating or greater.
 - 2. All pipe, 4” and greater shall have standard iron pipe size (IPS) outside diameter.
 - 3. The individual who performs the joint fusion shall have written certification from an HDPE pipe manufacturer or supplier stating he/she has successfully completed a certification class on joint fusion techniques and procedures. In addition, this individual is to have fused a combined total of more than 5,000 feet of HDPE piping in diameters 4-inches and larger.

END OF SECTION

SECTION 02702 – CONSTRUCTION SURVEYING, PART 3 – EXECUTION, Article 3.1, CONSTRUCTION, *add the following to paragraph D:*

- 1. A closed level loop is required through TBMs listed in the Drawings. No side shots will be permitted. A copy of the surveyor’s notes shall be provided to the ENGINEER. No payment will be made for Pay item No. 2702.1 until the ENGINEER has received a copy of these surveyor’s notes.
- 2. Global Position System (GPS) survey methods shall not be used for grading control unless approved in writing by the ENGINEER.

END OF SECTION

SECTION 01 15 37 – BYPASS PUMPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Bypass pumping shall include all materials, those detailed in the plans and specifications, and those incidental as required to complete the work in a safe manner to ensure continuous sewer service to the upstream sewer basins from the existing Outer Drive and West Juneau Pump Stations for the duration of construction.

1.2 REFERENCE DOCUMENTS

- A. CBJ Ordinance 2013-14(c)

1.3 SUBMITTALS

- A. Action Submittals:

- 1. Bypass Pumping Program including:

- a. Bypass narrative detailing the approach and sequencing for the duration of the sewer interruption.
- b. Specifics of method for bypass pumping during the Outer Drive Junction Manhole retrofit work.
- c. Annotated site layouts
- d. Material data sheets for pipe, valves, and pumps to be used
- e. Bypass pump performance curves and expected operating range
- f. Controls scheme and alarm system
- g. Contingency plan for failure of primary bypass pumping system
- h. Traffic Control Plan
- i. Noise Permit (if applicable)

PART 2 – PRODUCTS

1.1 PUMPS

- A. Pumps used for the duration of temporary bypass pumping shall have a design flow and head rating that meets the system curve criteria as detailed in the Drawings.
- B. Bypass pumps shall be capable of passing 3-inch solids and handling raw, unscreened sewage containing debris such as: gravel, rags, and other fibrous materials.
- C. Pumps shall be self-priming and non-clog, or chopper style pump
- D. Two pumps shall be required for each station bypass:

SECTION 01 15 37 – BYPASS PUMPING

1. One, primary pump used during bypass operations and,
2. One redundant pump kept on-site or in lag position in case of failure of the primary pump
3. Each pump shall be capable of meeting the above listed criteria

1.2 PIPING

- A. Piping used for bypass pumping shall be composed of new or used material that does not leak during operation.
- B. Piping shall not be aluminum irrigation pipe or solvent cement PVC.
- C. Flexible hosing shall have a minimum pressure rating of 100 psi.
- D. Above ground pipe shall be entirely restrained joint with thrust blocking, or in substitute, adequate thrust blocking to prevent pipe movement, and joint pullout from occurring as result of hydraulic forces, thermal expansion and contraction of the pipe, or construction equipment and activities on site.

1.3 VALVES

- A. Each bypass line shall be equipped with a check valve to prevent backflow and a plug valve for purposes of isolation during start-up, operation, and shutdown of the temporary system.

1.4 CONTROL SYSTEM

- A. Pumps shall be automated to run independent of human input during day and nighttime operations for the duration of the sewer interruption and may include float or transducer, switches and relays to initiate or terminate pumping on a routine basis with increased or decreased sewer flow rates throughout the diurnal pattern.

PART 3 – EXECUTION

1.5 COORDINATION

- A. The Contractor shall coordinate the Bypass Pumping Program with the CBJ Wastewater Department's Scott Simonson (907-586-0393 x4257). Upon submittal and approval of the Bypass Pumping Program, the Contractor shall contact the CBJ Wastewater Department no fewer than 3 business days in advance of each planned bypass implementation. System surcharge capacity for bypass implementation will vary by station, with weather conditions, and tide level. CBJ Wastewater may in its sole discretion require bypass implementation during periods of low wastewater flow, typically between 12AM and 5AM. For Bypass Pumping Programs conforming to the conditions listed in this section, a maximum of 1.5 hours of surcharge time is expected. All Bypass Pumping Programs are subject to the following conditions:
 1. Bypass implementation shall not occur during any high tide event and in no instance where tide levels exceed 17-feet as measured against the Mean Lower Low Water datum.
 2. Bypass implementation shall not occur during rainfall events of one half inch or more in a 24 hour period as forecast by the National Weather Service.

SECTION 01 15 37 – BYPASS PUMPING

1.6 TRAFFIC CONTROL

- A. The Contractor is responsible for developing and submitting a traffic control plan to AK DOT&PF for review and approval. The plan shall include provisions for vehicular and pedestrian traffic, base flow and emergency bypass pumping operations.
- B. Bypass system features shall not impede traffic or access to homes/businesses/agencies.
- C. Contractor shall post the recommended speed reduction for proper use and protection of any ramps and bypass line connections installed.

1.7 FIELD QUALITY CONTROL

- A. Contractor shall test the bypass system in actual field conditions upon completing the installation, and each redundant pump and its ancillary equipment in the presence of the Owner before commencing with any Pump Station decommissioning activities.

1.8 NOISE CONTROL

- A. Bypass pumping operations shall conform to CBJ Ordinance 2013-14(c) (Noise Ordinance). Electrically driven components producing minimal noise are encouraged. Diesel driven or similar mechanically driven components proposed for bypass operation shall be commercially produced sound attenuated models. The use of any component or combination of components shall not cause an unreasonable noise as defined in the Noise Ordinance. Where chosen components or bypass activity requires, the contractor is solely responsible for obtaining a noise permit through the CBJ building official.

END OF SECTION

SECTION 01 15 37 – BYPASS PUMPING

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SECTION 02 41 00 – DEMOLITION

PART 1 – GENERAL

1.1 THE REQUIREMENT

- A. Prior to the start of the WORK, the CONTRACTOR shall coordinate with the OWNER regarding items from the existing lift station to be salvaged and delivered to the CBJ Wastewater department by the CONTRACTOR. The CONTRACTOR shall dispose of all other items at the CONTRACTOR's expense.
- B. The CONTRACTOR shall furnish materials, equipment, and labor necessary to perform and complete demolition WORK called for in the Contract Documents.
- C. The existing Outer Drive and West Juneau Lift Stations process equipment including pumps, piping, and electrical shall be removed and disposed of in an orderly and careful manner.
- D. The WORK shall include, but not be limited to, removal and disposal of existing piping, pumps, pump housing, mechanical and electrical appurtenances, wiring, structural concrete, grout shaping, valves and slide gates, hatches, doors, HVAC system and other equipment and materials to the extents shown on the Drawings.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All codes, as referenced herein, are specified in Section 01090, "Reference Standards."

1.3 CONTRACTOR SUBMITTALS

- A. Demolition Schedule: The CONTRACTOR shall submit a complete coordination schedule for demolition WORK including shut-off and continuation of utility services prior to start of the WORK. The schedule shall indicate proposed methods and operations of facility demolition and provide a detailed sequence of demolition and removal WORK to ensure uninterrupted operation of occupied areas.

1.4 JOB CONDITIONS

- A. Condition of Facilities: OWNER assumes no responsibility for actual condition of facilities to be demolished. The CONTRACTOR shall visit the site and inspect the existing facilities.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 02 41 00 – DEMOLITION

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SECTION 030100 – MAINTENANCE OF CONCRETE

PART 1 – GENERAL

1.1 SUBMITTALS

- A. Provide repair mortar for vertical overhead or horizontal patch and repair of existing substrate.
- B. Related Sections: Other specification sections which relate directly to the work of this section include the following:

Section 3301: Structural Concrete (CBJ Standard Specifications)

Section 3302: Concrete Structures (CBJ Standard Specifications)

1.2 SUBMITTALS

- A. Comply with Section 01300.
- B. Product Data: Submit manufacturer's product data and installation for each material and product used. Include manufacturer's Material Safety Data Sheets.

1.3 REFERENCES

- A. ASTM C 109: Compressive Strength of Hydraulic Mortars
- B. ASTM C 191: Setting Time of Hydraulic Cement
- C. ASTM C 882: Slant Shear Bond Strength
- D. ASTM C 928: Rapid Hardening Cementitious Materials for Concrete Repairs
- E. Utah D.O.T. Bond/Slant Shear Testing.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: The manufacturer shall be a company with at least fifteen years experience in the manufacturer and marketing of pre-packaged cementitious repair materials.
- B. Installer's Qualifications: The contractor shall be qualified to perform the work specified by reason of experience. Successful completion of a minimum of 5 projects of similar size and complexity to specified Work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.
- B. Store products in a dry area. Protect from direct sunlight.
- C. Handle products in accordance with manufacturer's printed recommendations.

SECTION 030100 – MAINTENANCE OF CONCRETE

PART 2 – PRODUCTS

2.1 MATERIALS

A. Polymer modified, shrinkage compensated, rapid setting high strength, hydraulic cement based repair mortar. Comply with the following:

1. Manufacturer:

- a. Fastset™ Repair Mortar (#1241) as manufactured by the QUIKRETE® Companies, One Securities Centre, 3490 Piedmont Road, NE, Suite 1300, Atlanta, GA 30305; telephone (404) 634-9100.
- b. MasterEmaco® T 1061EX Repair Motor as manufactured by the BASF Corporation Construction Chemicals, 889 Valley Park Drive, Shakopee, MN 55379; telephone: (800) 433-9517

2. Performance and Physical Properties at 73 degrees F (23°C) and 50 percent relative humidity:

- a. Compliance: ASTM C 928 R-2 specifications
- b. Setting time, ASTM C 191: 20-40 minutes
- c. Compressive Strength, ASTM C 109 Modified: 2000 psi (13.8 MPa) @ 3 hours, 4000 psi (27.6 MPa) @ 24 hours, 5000 psi (34.5 MPa) @ 7 days and 6000 psi (41.4 MPa) @ 28 days
- d. Slant Shear Bond Strength, ASTM C 882: 1000 psi (6.9 MPa) @ 24 hours, 1500 psi (10.3 MPa) @ 7 days and 2500 psi (17.2 MPa) @ 28 days
- e. Consistency: Gel-like
- f. Unit weight lb/cu ft: ~128 lbs (2051 kg/m³)

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas landscaping from contact due to mixing and handling of materials.

3.2 SURFACE PREPARATION:

Comply with manufacturer's printed instructions and the following:

- A. Remove all spalled and unsound concrete from area to be repaired. If rusty reinforcing steel is present; it must be abrasive blasted to remove rust.
- B. Remove enough material to completely expose reinforcing steel.
- C. Large vertical or overhead patches deeper than 2" (50 mm) should contain reinforcing

SECTION 030100 – MAINTENANCE OF CONCRETE

steel. Additional steel should be inserted using appropriate techniques, if none is present.

D. Clean surface to be repaired of all materials including dust, oil, dirt and grease.

E. Dampen with clean water before patching and remove standing water.

3.3 MIXING:

Comply with manufacturer's printed instructions and the following:

A. Mix continuously at slow speed to avoid air entrainment.

B. Mix for minimum of 3 minutes until fully homogenous.

C. Mix no more material than can be placed in 20 to 30 minutes at 70 degrees F (21 degrees C) and 50 Percent relative humidity.

D. Do not re-temper with additional water.

3.4 APPLICATION:

Comply with manufacturer's printed instructions and the following:

A. Material should be trowel applied to a damp surface.

B. Apply a thin layer with heavy trowel pressure and then build up to the desired thickness. Material obtains high bond strength without the use of bonding adhesives or acrylic additives.

C. After initial set, the material may be trimmed and shaped to match the contours of existing patch area.

D. Ensure proper consolidation of mortar and compaction around reinforcing steel.

E. Do not apply if temperatures are below 40°F (4°C) or are expected to go below 32° (0°C) within a 24 hour period. Use cold water in hot weather or hot water in cold weather to achieve desired grout temperature.

3.5 CURING

A. No special procedures are required. During the first 24 hours, keep the patch covered or damp to prevent excessive loss of water.

3.6 CLEANING

A. Remove excess material before material cures. If material has cured, remove using mechanical methods that will not damage substrate.

3.7 PROTECTION

A. Protect repair mortar from damage during construction.

SECTION 030100 – MAINTENANCE OF CONCRETE

END OF SECTION

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1. DESCRIPTION

- A. Section Includes:
 - 1. Miscellaneous steel framing and supports.
 - 2. Metal floor plate.
 - 3. Miscellaneous steel trim.
 - 4. Loose bearing and leveling plates.
 - 5. Cold-formed steel framing materials.

1.2. ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Fasteners.
 - 2. Shrinkage-resisting grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing. Show anchorage and accessory items.

1.3. INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.4. QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3/D1.3M, "Structural Welding Code – Sheet Steel."
 - 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

PART 2 - PRODUCTS

2.1. METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- D. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- E. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- F. Rolled-Stainless Steel Floor Plate: ASTM A793.

SECTION 055000 – METAL FABRICATIONS

- G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- I. Cold-Formed Steel Framing: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - a. Grade: ST33H for material 43 mil or lighter, ST50H for material 54 mil and heavier.
 - b. Coating: G90
- J. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- K. Aluminum Shapes: Alloy 6061-T6.
- L. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

2.2. FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for fastening aluminum or stainless steel, hot-dip galvanized fasteners for fastening galvanized steel, and plain steel fasteners for fastening plain steel. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.
- E. Anchor Bolts: ASTM F1554, Grade 55, weldable, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
- F. Post-Installed Anchors: Chemical anchors.
 - 1. Material: ASTM F1554, Grade 55, weldable, straight, threaded rod; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and flat washers.
 - 2. Material Where Stainless Steel Is Indicated: Alloy Group 2 stainless steel threaded rod, ASTM F593, and nuts, ASTM F594; and flat washers.

2.3. MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- C. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

SECTION 055000 – METAL FABRICATIONS

2.4. FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.5. MISCELLANEOUS FRAMING AND SUPPORTS

- A. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.6. METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor, rolled-stainless steel floor, or rolled-aluminum-alloy tread plate of thickness as indicated on Drawings.
- B. Include angle stiffeners and fixed and removable sections as indicated.
- C. Provide flush bar drop handles for lifting removable sections, one at each end of each section.

2.7. MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

SECTION 055000 – METAL FABRICATIONS

- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - C. Galvanize miscellaneous steel trim.
- 2.8. LOOSE BEARING AND LEVELING PLATES
- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
 - B. Galvanize bearing and leveling plates.
- 2.9. GENERAL FINISH REQUIREMENTS
- A. Finish metal fabrications after assembly.
- 2.10. STEEL AND IRON FINISHES
- A. Galvanizing: Hot-dip galvanize items in accordance with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - B. Cold Galvanizing Compound: organic zinc-rich coating containing 95% metallic zin, by weight in the dry film; recognized under the Component Program of Underwriter’s Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to Federal Specification DOD-P-21035A for repair of hot-dip galvanizing and meeting the requirements of Military Specification MIL-P-26915A USAF Specification for Zinc-Rich Paints.

PART 3 - EXECUTION

- 3.1. INSTALLATION, GENERAL
- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
 - B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

SECTION 055000 – METAL FABRICATIONS

- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2. INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3. INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4. REPAIRS

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 055000 – METAL FABRICATIONS

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SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Republic Doors and Frames.
 - 4. Steelcraft; an Allegion brand.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: Flat face, no openings.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Core: Manufacturer standard.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.

2.3 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry-Wall Type: Designed to engage masonry wall, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

2.4 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B galvanized; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B galvanized; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B galvanized .
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated to Masonry openings.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."

2.5 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 - 3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 5. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

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2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

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- f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. At Bottom of Door: **5/8 inch (15.8 mm)** plus or minus 1/32 inch (0.8 mm).
 - c. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 083113 – ACCESS HATCHES AND FRAMES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide access hatches with fall-through protection, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. Shop Drawings
 - 1. Submit the following:
 - a. Drawings of hatches and fall-through grating.
 - b. Catalog cuts and general arrangement drawings of the gate assemblies are not considered acceptable for shop drawings.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Hatches shall comply with the following Standards:
 - 1. OSHA 1910-23 Ladders
 - 2. OSHA 1910-146 Permit-required confined spaces
- B. Hatches shall be aluminum and shall seal airtight in the closed position. Hatch hinges and attaching hardware shall be of T-316 stainless steel. Hatch doors shall be outfitted with a combined pneumatic and spring assisted device; these devices shall be fabricated from stainless steel or other appropriate durable corrosion resistant material.
- C. Hatches for the wet well shall be Halliday Products Model “F1C”, or equivalent, pedestrian rated for use outside the lift station building for access to the wet well and level sensing instrumentation. Hatches shall be sized per the dimensions provided in the construction drawings.
- D. Fall through protection shall be Halliday Products Series X Retro-Grating, which shall be fabricated from corrosion resistant structural aluminum and installed in accordance with the manufacturer’s printed instructions.
- E. Hinged aluminum grate doors shall be provided. Grate doors shall be provided with a permanent hinge system that will lock the grating in the 90 degrees position once opened. Grating shall be painted with OSHA type safety orange paint. Grating doors shall feature a locking device to provide a second level of protection against unauthorized entry to the confined space.

SECTION 083113 – ACCESS HATCHES AND FRAMES

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Hatches shall be flush mounted on modified concrete ledge.
- B. Location of the grating system shall allow visual inspection of the wet well and adjustment and cleaning of the liquid level sensor without need for personnel to enter the confined space.

END OF SECTION

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors.
- B. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
 - 1. Builders Hardware Manufacturing Association (BHMA)
 - 2. NFPA 101 Life Safety Code
 - 3. NFPA 80 -Fire Doors and Windows
 - 4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
 - 5. UL10C – Positive Pressure Fire Test of Door Assemblies
 - 6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
 - 7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
 - 8. ICC – International Building Code

1.2 SUBMITTALS:

- A. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
 - 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
 - 4. Submit catalog cuts with hardware schedule.
- B. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
 - 1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

1.3 QUALITY ASSURANCE

- A. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Engineer in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Engineer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Comply with manufacturer's recommendations.

1.5 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

SECTION 087100 – DOOR HARDWARE

- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.
- 1.6 WARRANTY:
- A. Manufacturer's Warranty:
 - 1. Closers: Lifetime
 - 2. Locksets & Cylinders: Seven years
 - 3. All other Hardware: Two years.
- 1.7 OWNER'S INSTRUCTION:
- A. Instruct Owner's personnel in operation and maintenance of hardware units.
- 1.8 MAINTENANCE:
- 1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 - 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 - 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- 1.9 MATERIALS:
- A. Hinges:
 - 1. Template screw hole locations
 - 2. Minimum of 2 permanently lubricated non-detachable bearings
 - 3. Equip with easily seated, non-rising pins
 - 4. Sufficient size to allow 180-degree swing of door
 - 5. Furnish hinges with five knuckles and flush bearings
 - 6. Provide hinge type as listed in schedule.
 - 7. Furnish 3 hinges per leaf.
 - 8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
 - B. Cylindrical Type Locks and Latchsets:
 - 1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
 - 2. Provide 9001-Quality Management and 14001-Environmental Management.
 - 3. Fit modified ANSI A115.2 door preparation.
 - 4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
 - 5. Locksets to have anti-rotational studs that are thru-bolted
 - 6. Keyed lever shall not have exposed "keeper" hole
 - 7. Each lever to have independent spring mechanism controlling it
 - 8. 2-3/4 inch (70 mm) backset
 - 9. 9/16 inch (14 mm) throw latchbolt
 - 10. Provide sufficient curved strike lip to protect door trim
 - 11. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
 - 12. Keyed lever to be removable only after core is removed, by authorized control key

SECTION 087100 – DOOR HARDWARE

13. Provide locksets with Stanley Security/BEST removable and interchangeable core cylinders.
 14. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
 15. Locksets outside locked lever must withstand minimum 1400 inch-pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
 16. Core face must be the same finish as the lockset.
 17. Functions and design as indicated in the hardware groups.
- C. Cylinders:
1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
 2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
 3. Coordinate and provide as required for related sections.
- D. Door Closers shall:
1. Tested and approved by BHMA for ANSI 156.4, Grade 1
 2. UL10C certified
 3. Provide 9001-Quality Management and 14001-Environmental Management.
 4. Closer shall have extra-duty arms and knuckles
 5. Conform to ANSI 117.1
 6. Maximum 2 7/16 inch case projection with non-ferrous cover
 7. Separate adjusting valves for closing and latching speed, and backcheck
 8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
 9. Full rack and pinion type closer with 1½“ minimum bore
 10. Mount closers on interior side of door,
 11. Closers shall be non-handed, non-sized and multi-sized.
- E. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- F. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Surface overhead stops shall be heavy duty bronze or stainless steel.
- G. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- H. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.

SECTION 087100 – DOOR HARDWARE

1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
2. UL10C Positive Pressure rated seal set when required.

1.10 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

1.11 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Best key core, 1MT12 in a G keyway in a 6 pin core with Stainless steel 626 finish.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
 1. 2 each Change keys each keyed core
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 1. Do not proceed until unsatisfactory conditions have been corrected.

SECTION 087100 – DOOR HARDWARE

3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder’s Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
 - 3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 - 1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - 1. Check and adjust closers to ensure proper operation.
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - 3. Report findings, in writing, to Engineer indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

Finish List

Code	Description
AL	Aluminum
PC	Prime Coat
26D	Satin Chrome
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized

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630	Satin Stainless Steel
689	Aluminum Painted
GREY	Grey
BLACK	Black
US32D	Stainless Steel, Dull

Manufacturer List

Code	Name
AB	ABH Manufacturing Inc.
BE	Best Access Systems
NA	National Guard
PR	Precision
SD	Stanley Door Closers
SH	Stanley Commercial Hardware
ST	Stanley
TR	Trimco

Hardware Sets

SET #1- Outer Drive Pump Station

X	Hinges CB1900R 4 1/2 x 4 1/2	26D	ST
X	Door Closer QDC115	689	SH
X	Lockset 9K3-7D14D PATD S3	626	BE
X	Surface Overhead Stop 4420 Series		US32D AB
X	Door Silencers 1229A	GREY	TR

SET #2- West Juneau Pump Station

X	Hinges CB1900R 4 1/2 x 4 1/2	26D	ST
X	Door Closer QDC115	689	SH
X	Lockset 9K3-7D14D PATD S3	626	BE
X	Surface Overhead Stop 4420 Series		US32D AB
X	Door Silencers 1229A	GREY	TR

END OF SECTION

SECTION 099700 – SPECIAL COATINGS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. SCOPE: The work specified under this section includes furnishing and applying all coating and/or lining for all equipment, valves, piping, piping accessories, submerged metal, exposed metal, and materials as detailed in the plans or these specifications.
- B. New process pipe and fittings in this project shall be factory primed and field top-coated prior to installation, unless otherwise approved. Coating damaged during installation shall be repaired in place.
 - 1. New process piping will be placed in service immediately with no time available for painting and curing prior to return to service.
- C. Existing process piping scheduled for recoating shall be prepared via vapor blast or pressure wash as required by the existing pipe condition and coating surface preparation requirements to attain sufficient coating adhesion. Dry sand blast will not be permitted inside the facility.

1.2 GENERAL

- A. This work includes application of special coating systems to items and surfaces including surface preparation, priming and topcoats.
 - 1. The work includes application of special coating systems for scheduled surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.
 - 2. Coat surfaces for special coating systems whether or not colors are designated, except where specifically noted as a surface not to be painted.
 - 3. "Exposed surfaces" is defined to include areas visible when permanent or built-in fixtures are in place in areas scheduled to be coated. Extend special coatings in these areas as required to maintain coating system integrity and provide desired protection.
 - 4. Where items or surfaces are not specifically mentioned, apply special coatings to these the same as adjacent similar materials or areas.
- C. All piping, valves and equipment used on this project shall be coated for corrosion protection unless otherwise specified or unnecessary given the type of metal or material.

1.3 QUALITY ASSURANCE

- A. Coordination: Provide finish coats which are compatible with and per the same manufacturer as prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coating systems for various substrates. Upon request, furnish information on characteristics of specified finish materials, to ensure that compatible prime coats are used. Notify owner's construction representative of any anticipated problems using coating systems as specified.

SECTION 099700 – SPECIAL COATINGS

1.4 SUBMITTALS

- A. **Product Data:** Submit manufacturer's technical information including basic materials analysis and installation instructions for each material specified. List each material and cross-reference to the specific coating and finish system and application. Identify by manufacturer's catalog number and general classification. Submittals shall be in accordance with Section 01300 and the General Conditions.
- B. **NSF Certification:** Submit certifications showing ANSI/NSF 61 approval for potable water contact. Note: NSF & UL are certified labs to test potable water coatings to the ANSI/NSF 61 Standard.
- C. **Samples:** Upon request by OWNER or ENGINEER, submit samples for OWNER's construction representative's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1.5 DELIVERY AND STORAGE

- A. Deliver materials in original, new and unopened packages and containers bearing manufacturer's name and label and following information:
 - 1. Name or title of material
 - 2. Manufacturer's stock number and date of manufacture
 - 3. Manufacturer's name
 - 4. Contents by volume, for major pigment and vehicle constituents
 - 5. Application instructions
 - 6. Color name and number
- B. Take precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of special coatings.

1.6 JOB CONDITIONS

- A. Do not apply coatings when the temperature of surfaces to be painted and the surrounding air temperatures are or are expected to go below temperatures recommended by manufacturer, 45°F (7°C) or less than 5°F above the dew point unless otherwise permitted by coating manufacturer's printed instructions.
- B. Do not apply coatings in snow, rain, fog, or mist; or when relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by coating manufacturer's printed instructions.
- C. Coating work may be continued during inclement weather only if areas and surfaces to be painted are enclosed and heated within temperature and humidity limits specified by coating manufacturer during application and curing period.

SECTION 099700 – SPECIAL COATINGS

PART 2 - PRODUCTS

2.1 MATERIALS QUALITY

- A. Provide best quality grade of various types of coatings as regularly manufactured by acceptable coating materials manufacturers. Use only materials displaying manufacturer's identification as a standard, best-Manufacturer's products which comply with coating qualitative requirements of applicable Federal Specifications. Materials that differ in quantitative requirements may be considered for use when acceptable to the ENGINEER. Furnish material data and manufacturer's certificate of performance to ENGINEER for proposed substitutions. All materials specified herein shall be manufactured by TNEMEC Company, Inc., Sherwin Williams or Engineer Approved equal are approved for use on this project.
1. Tnemec: Epoxy-Polyamide Potable System, Series N140 Pota-Pox Plus, Series N140 Pota-Pox Plus. Sherwin Williams Macropoxy 646 PW
 2. Tnemec, or Sherwin Williams: Epoxy-Polyamide Non-Potable System, Series N69 Epoxoline II, or Sherwin Williams Dura-Plate 235
 - a. Alternative: Sherwin Williams: Corothane 1, Mio-Aluminum; Sherwin Williams Corothane 1, Aliphatic Finish Coat
 3. Tnemec, or Sherwin Williams: Polyamide Epoxy-Coal Tar, Tnemec Hi-Build Tneme-Tar 46H-413, or Sherwin Williams Hi-Mil Sher-Tar
- B. Equivalent materials manufactured by other industrial coatings manufacturers may be submitted for approval by the Engineer and Owner. Requests for product approval shall include a list of 5 projects where each product has been used and has provided satisfactory service for at least seven years. No request for approval shall be considered that would decrease film thickness or number of coats or that would offer a change in the generic type of coating specified. In addition, no request for approval shall be considered which does not have certified test reports showing equivalency to the performance criteria of the specified coatings. Any product submitted for approval as a coating for submerged metal must have current National Sanitation Foundation (NSF) Std. 61 approval for contact with potable water.
- C. Provide undercoat recommended by manufacturer of finish coat. Use only thinners approved by coating manufacturer and use only within recommended limits.
- D. Colors and Finishes: Paint colors, surface treatments, and finishes, are indicated in the schedule of Section 2.04. If color or finish is not designated, owner's construction representative will select from standard colors available from manufacturer of materials systems as specified.
- E. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.
- F. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated, including those approved for potable water for systems applied to objects submerged

2.2 EQUIPMENT

- A. All equipment in Divisions 40 not called out in related work (Section 1.2) shall be coated per equipment manufacturer's recommendation for the environment in which the equipment is to be placed and coated at the factory.

SECTION 099700 – SPECIAL COATINGS

2.3 COATING SYSTEMS

A. Coating systems used on the project shall be as identified below, or approved equals.

1. All Systems: Each coating system shall be applied in accordance with the schedule in Section 2.4. Surface preparation, application, and curing shall be in accordance with manufacturer’s recommendations and application shall be completed by a trained applicator with equipment approved by manufacturer of coating system.
2. Systems A & B: See Section 2.4.
3. System C: Buried metal, valves, pipe and pipe accessories.
4. Where surface is not provided with other protection, apply two coats of Tnemec coal-tar epoxy 46H-413, or equal. Where additional protection is provided, such as a polyethylene wrap or other system approved by the ENGINEER, apply one coat of Tnemec system, 46H-413 or equal.

2.4 COATING SYSTEM SCHEDULE

ITEM	PREP	COATING	COATS/THICKNESS
*System A:			
Submerged Equipment, piping, valves, misc. metals	SSPC-10-89	Primer: Tnemec Series N140 Pota-Pox	(1)/Primer: 5-6 mils DFT
		Plus; Sherwin Williams Macropoxy 646 PW Top Coat: Tnemec Series N140 Pota-Pox Plus; Sherwin Williams Macropoxy 646 PW	
		Top Coat: Tnemec Series N140 Pota-Pox Plus; Sherwin Williams Tank Clad HS	(1)/Top Coat :10 - 12 mils (Min. System Thickness 16 mils per AWWA C210
*System B:			
Interior & Exposed equipment, piping, valves, misc. metals	SSPC-SP-6 (as applicable)	Primer: Tnemec Series N69 Epoxy Polyamide.; Sherwin Williams Dura-Plate 235	(1)/Primer: 4-6 mils
		Top Coat(interior): Tnemec Series N69; Sherwin Williams Dura-Plate 235	(1)/Top Coat (int): 4-6 mils Total Film

SECTION 099700 – SPECIAL COATINGS

*System B – Alt:			
Interior & Exposed equipment, piping, valves, misc. metals (High humidity applications.)	SSPC-SP-6 (as applicable)	Sherwin Williams: Corothane 1, Mio-Aluminum; Sherwin Williams Corothane 1, Aliphatic Finish Coat	Primer: 2 - 3 mils Top Coat: 2 – 3 mils Total Film: 4 – 6 mils DFT
*System C:			
Buried Metal valves, pipe, etc.	As required by manufacturer	Tnemec Coal Tar-Epoxy 46H-413. SW-Hi-Mil Sher-Tar B69	(1 or 2) 16-20 mils

- A. *Cast iron surface preparation as per a SSPC designation is not applicable. Cast iron shall be prepared in accordance with guidelines specified herein. Other metals shall be prepared in accordance with the noted SSPC designation.

2.5 COLOR CODING

- A. Refer to the piping schedule in the drawings and the below table for the color requirements.

- 1. Non-potable Water Line - Blue with Black Bands
- 2. Sewage (wastewater) Line - Gray

- B. Primer should be of distinctly different color than topcoat to facilitate coverage visibility during application and quality control. The contents and direction of flow must be stenciled on the piping in Black.

PART 3 - EXECUTION

3.1 INSPECTION BY CONTRACTOR

Starting of coatings work will be construed as Applicator's acceptance of surfaces within any particular area.

Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable coating film. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

3.2 SURFACE PREPARATION

- A. General: Perform preparation and cleaning procedures in compliance with coating manufacturer's instructions for particular substrate conditions, and as herein specified.
- B. Remove hardware, hardware accessories, machined surface, plates, lighting fixtures, and similar items which are not to be coated, or provide surface-applied protection prior to surface preparation and coating operations. Remove, if necessary, for complete coating of items and adjacent

SECTION 099700 – SPECIAL COATINGS

surfaces. Following coating completion in each space or area, reinstall removed items, using workman skilled in trades involved.

- C. Clean surfaces to be coated before applying coatings or surface treatment; with solvents prior to mechanical cleaning. Program cleaning and application so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.
- D. Ferrous Metal Surfaces: Clean non-galvanized, ferrous surfaces, which have not been shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent and/or mechanical cleaning, complying with Steel Structures Painting Council (SSPC) recommendations.
 - 1. Touch-up shop applied prime coats which have been damaged or bare areas. Wire-brush, solvent clean, and touch-up with same primer as shop coat.
 - 2. Commercial Blast Cleaning (SSPC-SP6): A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining as follows: Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied paint. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted.
 - 3. Near White Blast Cleaning (SSPC-10): A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining as follows: Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discolorations caused by stains of mill scale, or stains of previously applied paint.
 - 4. Cast iron pipe shall be solvent cleaned of any grease, oil or other surface contaminants and then cleaned of the solvent prior to evaporation. Following solvent cleaning, cast iron shall be brush blasted to develop a minimum 1.5 mil surface profile and cleaned of any dust remaining after blasting.
- E. Non-Ferrous Metal Surfaces: Clean non-ferrous and galvanized surfaces in accordance with special coating system manufacturer's instructions for type of service, substrate, and application required.

3.3 MATERIALS PREPARATION

- A. General: Carefully mix and prepare materials in compliance with manufacturer's directions.
- B. Do not mix coating materials produced by different manufacturers, unless otherwise permitted by manufacturer's instructions. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.
- C. Stir materials before application to produce a mixture of uniform density, and as required during application. Do not stir film, which may form on surfaces, into material. Remove film and, if necessary, strain material before using.

SECTION 099700 – SPECIAL COATINGS

3.4 APPLICATION

- A. General: Apply special coatings by brush, roller, spray, squeegee, or other applicators in accordance with manufacturer's directions – see exceptions. Use applicators best suited for type of material being applied. Equipment shall be coated at the factory.
 - 1. Exceptions: All mechanical piping shall be spray painted, unless otherwise approved by the ENGINEER.
- B. The number of coats and paint film thickness required is same regardless of the application method. Do not apply succeeding coats until previous coat has cured as recommended by coating manufacturer. Sand between coat applications where required to produce an even smooth surface in accordance with coating manufacturer's directions.
 - 1. Apply additional coats when undercoats or other conditions show through final coat until the cured film is of uniform finish, color and appearance.
 - 2. Coat back sides of access panels, removable or hinged covers to match exposed surfaces.
- C. Prime Coats: Before application of finish coats, apply prime coat to material, which is required to be painted or finished, and which has not been prime coated by others.
 - 1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
 - 2. Recoat or prepare any primed surfaces that have been exposed for beyond the manufacturer's allowable set time for primed surfaces. Prepare surface or recoat as required by manufacturer.
- D. Minimum Coating Thickness: Apply each material at not thinner than manufacturer's recommended spreading rate. Provide a total dry film thickness of entire coating system as recommended by manufacturer, unless otherwise indicated.
- E. Brush Applications: Brush-out and work brush coats onto the surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks. Brush apply primer or first coats, unless otherwise permitted to use mechanical applicators.
- F. Mechanical Applications: Use mechanical methods for coating application when permitted by coating material manufacturer's recommendations.
 - 1. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass.
- G. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or recoat work not in compliance with specified requirements. If required paint film thickness is not achieved, additional coats shall be applied per manufacturer's directions until the required thickness is obtained.

SECTION 099700 – SPECIAL COATINGS

3.5 FIELD QUALITY CONTROL

- A. The right is reserved by the OWNER to involve following material testing procedure at any time, and any number of times during period of field painting:
1. The OWNER may engage service of an independent testing laboratory to sample materials being used. Samples of materials delivered to project site may be taken, identified and sealed, and certified in presence of CONTRACTOR.
 2. Testing laboratory may perform appropriate tests for any of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance coating thickness, holidays and quantitative materials analysis.
 3. If test results show materials being used do not comply with specified requirements, CONTRACTOR may be directed to stop work, remove non-complying materials; pay for testing; recoat surfaces coated with rejected materials; and remove rejected materials from previously painted surfaces if, upon recoating with specified materials, two coatings are non-compatible.

3.6 INSPECTION

- A. Dry film thickness shall be measured by a contractor-furnished non-destructive magnetic type thickness gage. Measurement procedures shall be as outlined in the SSPC Steel Structures Painting Manual Volume 2, Systems and Specifications. Any deficiencies in required film thickness shall be corrected by the contractor per the recommendations of the coating manufacturer. The thickness gage shall be accurately calibrated using U.S. Department of commerce, National Bureau of Standards Certified Calibrations Plates.
- B. **Low-Voltage Wet Sponge Holiday Testing is required for all immersion service steel.** All holidays will be re-dressed as directed by coating manufacturer.

3.7 CLEAN UP AND PROTECTION

- A. Clean-up: During progress of work, remove from project site discarded materials, rubbish, cans and rags resulting from work.
- B. Upon completion of work, clean all coating-spattered surfaces. Remove spattered materials by proper methods of washing and scraping, using care not to damage finished surfaces.
- C. Protection: Protect work of other trades, whether to be coated or not, against damage. Correct damage by cleaning, repairing or replacing, and recoating, as directed by OWNER's construction representative. Leave work in undamaged condition.
- D. Touch up all coated surfaces damaged during course of work to leave work in undamaged condition at the time of acceptance of project.
- E. Provide "Wet Paint" signs as required to protect finishes. After coating application, remove temporary protective wrapping provided by others for protection of their work during coatings operation.

END OF SECTION

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Mechanical sleeve seals.
 - 3. Formed steel channel

1.1 SUBMITTALS

- A. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- B. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

1.1 WATER QUALITY MAINTENANCE

- A. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.
- B. All piping, equipment, and components in contact with potable water, including, but not limited to, tanks, pumps, piping, valves, fittings and instrumentation, shall be ANSI/NSF-61 approved unless otherwise approved by ADEC. Materials in direct contact with drinking water shall be lead free in accordance with the "Reduction of Lead in Drinking Water Act":
 - 1. Not containing more than 0.2 percent lead when used with respect to solder and flux; and
 - 2. 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.

1.1 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2018 UPC and State of Alaska Amendments.
- B. Maintain one copy of each document on site.

PART 2 -- PRODUCTS

2.1 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: Stainless steel pipe.
- C. Sealant: Acrylic

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

2.1 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. GPT, Link-Seal.
 - 2. Substitutions: Permitted.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.1 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Cooper B-Line
 - 2. Unistrut
 - 3. Substitutions: Permitted.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.1 FIRESTOPPING

- A. Firestopping Materials: Acrylic based flexible firestop sealant, UL listed and FM approved.

PART 3 -- EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.

3.1 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install stainless steel escutcheons at finished surfaces.

3.1 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Use UL or FM approved flexible firestop sealant, installed per manufacturer's instructions.

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. Flashing.
 - 4. Firestopping
 - 5. Equipment Bases and Supports:

1.1 SUBMITTALS

- A. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, pipe hanger and support locations, and detail of trapeze hangers.
- B. Product Data:
 - 1. Hangers and Supports: Manufacturers catalog data including load capacity.
- C. 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.
- D. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.1 QUALITY ASSURANCE

- A. Fire-Resistant Joints in Fire-Rated Floor, Roof, and Wall Assemblies: UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- B. Fire-Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- C. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested according to ASTM E84.
- D. Perform Work according to AWS D1.1 for welding hanger and support attachments to building structure.
- E. Passivate stainless steel welds per ASTM A967. Confirm absence of free iron in heat affected zone using ASTM A967, Copper Sulfate Test, Practice C.
- F. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.
- G. Installer: Company specializing in performing Work of this Section with three years' experience.

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

1.1 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 -- PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO International Corporation
 - 3. Unitron Product, Inc. / US-Strut
 - 4. Substitutions Permitted
- B. Plumbing Piping – DWV & Facility Storm Drainage:
 - 1. Hangers shall be hot-dipped galvanized or stainless steel.
 - 2. Conform to MSS SP69.
 - 3. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Steel, adjustable swivel, split ring.
 - 4. Hangers for Pipe Sizes 2 inches and Larger: 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 hook.
 - 7. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 8. Vertical Support: Steel riser clamp.
 - 9. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 10. Copper Pipe Support: Vinyl coated, steel adjustable ring.
- C. Plumbing Piping - Water:
 - 1. Hangers shall be hot-dipped galvanized or stainless steel.
 - 2. Conform to MSS SP69.
 - 3. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Steel, adjustable swivel, split ring.
 - 4. Hangers for Cold Pipe Sizes 2 inches and Larger: Steel, adjustable clevis.
 - 5. Hangers for Hot Pipe Sizes 2 to 4 inches: Steel, adjustable clevis.
 - 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 7. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 - 8. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 9. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

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

10. Vertical Support: Steel riser clamp.
11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
14. Copper Pipe Support: Vinyl coated, Steel ring.

2.1 ACCESSORIES

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

2.1 FLASHING

- A. Metal Flashing: 26 gage stainless steel.
- B. Metal Counterflashing: 22 gage stainless steel.
- C. Lead Flashing:
 1. Waterproofing: 5 lb./sq. ft sheet lead.
 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thickness sheet butyl; compatible with roofing.
- E. Caps: Stainless steel, 22 gage minimum; 16 gage at fire resistant elements.

2.1 FIRESTOPPING

- A. Firestopping Materials: Acrylic based flexible firestop sealant, UL listed and FM approved.

PART 3 -- EXECUTION

2.1 PREPARATION

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

2.1 INSTALLATION

- A. Pipe Hangers and Supports: According to MSS SP 69.
- 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.

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

- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide vinyl coated hangers and supports in contact with copper piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.
- M. Equipment Bases and Supports:
 - 1. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.
 - 2. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
 - 3. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.
 - 4. Provide rigid anchors for pipes after vibration isolation components are installed.
- N. Flashing:
 - 1. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
 - 2. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
 - 3. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
 - 4. Seal floor, shower, and mop sink drains watertight to adjacent materials.
- O. Firestopping:
 - 1. Firestopping Materials installation: Install per manufacturer's instructions.

2.1 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
Cast Iron (All Sizes)	5	5/8

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

Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
PP-R, 2 inches and smaller	4	3/8
PP-R, 2-1/2 inches to 4 inches	5	1/2
PP-R, 4 inches and larger	6	1/2
PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8
Stainless Steel Tubing	4	3/8

END OF SECTION

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

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SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Stencils.
 - 4. Pipe markers.
 - 5. Labels.
 - 6. Lockout devices.

1.2 SUBMITTALS

- A. Product Data: Manufacturers catalog literature for each product required.
- B. Shop Drawings: 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.
- C. Manufacturer's Installation Instructions: Special procedures and installation.
- D. Manufacturer's Certificate: Products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.
- B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.5 QUALIFICATIONS

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

PART 2 -- PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved letters on contrasting background color.

2.2 TAGS

- A. Plastic Tags:
 - 1. Laminated three-layer plastic with engraved letters on contrasting background color. Tag size minimum 1-1/2 inches square.

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

B. Metal Tags:

1. Brass, aluminum or stainless steel with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. 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. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inch high letters.
4. Ductwork and Equipment: 1-3/4 inch high letters.

B. Stencil Paint: As specified in Section 09 97 00, 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. Provide markers with flow direction arrow.

B. Plastic Pipe Markers:

1. 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. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 LABELS

A. Description: polyester, size 1.9 x 0.75 inches, adhesive backed with printed identification.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Plastic device preventing access to valve operator, accepting lock shackle.

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 3 -- EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces according to Section 09 97 00 for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting according to Section 09 97 00.
- 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. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify piping, concealed or exposed, with plastic tape pipe markers. 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.

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

3.3 SCHEDULES

PIPE IDENTIFICATION			
SERVICE (TAG)	PIPE MARKER	BACKGROUND COLOR	LETTERING COLOR
COMPRESSED AIR	COMPRESSED AIR	YELLOW	BLACK
POTABLE COLD WATER (PW)	POTABLE COLD WATER	GREEN	BLACK
DOMESTIC HOT WATER (DHW)	DOMESTIC HOT WATER	YELLOW	BLACK
NATURAL GAS (NG)	NATURAL GAS	YELLOW	BLACK
SANITARY DRAIN (SD)	SANITARY DRAIN	GREEN	WHITE
SANITARY VENT (SV)	SANITARY VENT	GREEN	WHITE
RAINWATER LEADER (RWL)	ROOF DRAIN	GREEN	WHITE
UTILITY WATER (W3 & HW)	NON-POTABLE WATER	YELLOW	BLACK

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.

1.2 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 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.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 -- PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers; Glass Fiber and Mineral Fiber Insulation:
 - 1. Owens Corning
 - 2. Substitutions: Permitted.
- B. Manufacturers; Closed Cell Elastomeric Insulation:
 - 1. Armaflex
 - 2. Substitutions: Permitted.

SECTION 22 07 00 - PLUMBING INSULATION

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-5: ASTM C534, Type I, 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. Aluminum Pipe Jacket:
 - 1. ASTM B209
 - 2. Thickness: 0.020 inch thick sheet.
 - 3. Finish: Embossed.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

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. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum jacket single piece construction with self-adhesive closure. Thickness to match pipe insulation.

PART 3 -- EXECUTION

3.1 EXAMINATION

- A. Verify piping has been tested before applying insulation materials.
- B. 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.

SECTION 22 07 00 - PLUMBING INSULATION

- 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. Use UL or FM approved flexible firestop sealant, installed per manufacturer's instructions.
- C. 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.
- 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. Closed Cell Elastomeric Insulation:
 - 1. Push insulation on to piping.
 - 2. Miter joints at elbows.
 - 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 - 4. When application requires multiple layers, apply with joints staggered.
 - 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 8 feet above finished floor): Finish with aluminum jacket.
- H. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced

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vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

- 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. Heat Traced Piping Exterior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.
- K. Prepare pipe insulation for finish painting. Refer to Section 09 97 00.

3.3 SCHEDULES

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Domestic Hot Water (DHW)	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0
Domestic Cold Water (PW)	P-1 or P-5	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0
Santary Vent (SV) (within 3 ft of roof penetrations)	P-1 or P-5	All sizes	1.0
Rainwater Leader (RWL) (horizontal above ground within building) including Roof Drain bodies	P-1 or P-5	All sizes	1.0

END OF SECTION

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Domestic water piping, above grade.
 - 2. Unions and flanges.
 - 3. Valves.
 - 4. Pipe hangers and supports.
 - 5. Pressure gages.
 - 6. Pressure gage taps.
 - 7. Thermometers.
 - 8. Relief valves.
 - 9. Strainers.
 - 10. Hose bibs.
 - 11. Backflow preventers.

1.2 REFERENCE DOCUMENTS

- A. ASTM F2389-07 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
- B. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications
- C. NSF/ANSI 14 – Plastic Piping System Components and Related Materials

1.3 SUBMITTALS

- A. Product Data:
 - 1. Piping: Materials, fittings, and accessories. Manufacturer's catalog information.
 - 2. Valves: Manufacturers catalog information with valve data and ratings for each service.
 - 3. Domestic Water Specialties: Manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
 - 4. Pumps: Type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. NPSH curve. Electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions: Pumps, valves, and accessories.
- C. Manufacturer's Certificate: Products meet or exceed specified requirements.

1.4 WARRANTY

- A. Manufacturer shall warrant PP-R pipe and fittings for 10 years to be free of defects in materials or manufacturing.
 - 1. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

2. Warranty shall be in effect only upon submission by the contractor to the manufacturer valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

1.5 WATER QUALITY MAINTENANCE

- A. All piping, equipment, and components in contact with potable water, including, but not limited to, tanks, pumps, piping, valves, fittings and instrumentation, shall be ANSI/NSF-61 approved unless otherwise approved by ADEC. Materials in direct contact with drinking water shall be lead free in accordance with the "Reduction of Lead in Drinking Water Act":
 1. Not containing more than 0.2 percent lead when used with respect to solder and flux; and
 2. 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.

1.6 QUALITY ASSURANCE

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

PART 2 -- PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L drawn.
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder
- B. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized, cut grooved ends.
 1. Fittings: ASTM A395/A395M and ASTM A536 ductile iron, or ASTM A234/A234M carbon steel, grooved ends.
 2. Joints: Grooved mechanical couplings meeting ASTM F1476.
 - a. Housing Clamps: ASTM A395 and ASTM A536 ductile iron, enamel coated, compatible with steel piping sizes, rigid type.
 - b. Gasket: Elastomer composition for operating temperature range from minus 30 degrees F to 180 degrees F.
 - c. Accessories: Stainless steel bolts, nuts, and washers.

2.2 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
 1. Ferrous Piping: Class 150, malleable iron, threaded.
 2. Copper Piping: Class 150, bronze unions with soldered joints.
 3. 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. Ferrous Piping: Class 150, forged steel, slip-on flanges.

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2. Copper Piping: Class 150, slip-on bronze flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.3 GATE VALVES

- A. 2 inches and Smaller: MSS SP 80, class 125, bronze body, bronze trim, threaded bonnet, non-rising stem, hand wheel, inside screw with back-seating stem, solid wedge disc, solder or threaded ends.
- B. 2-1/2 inches and Larger: MSS SP 70, class 125, cast iron body, bronze trim, bolted bonnet, non-rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.4 GLOBE VALVES

- A. 2 inches and Smaller: MSS SP 80, class 125, bronze body, bronze trim, threaded bonnet, hand wheel, Buna-N composition disc, solder or threaded ends.
- B. 2-1/2 inches and Larger: MSS SP 85, class 125, cast iron body, bronze trim, hand wheel, outside screw and yoke, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.5 BALL VALVES

- A. 2 inches and Smaller: MSS SP 110, class 150, bronze, two-piece body, chrome plated bronze ball, full port, teflon seats, blow-out proof stem, solder ends with union, or threaded ends, lever handle.

2.6 BUTTERFLY VALVES

- A. 2-1/2 inches and Larger: MSS SP 67, class 150.
 1. Body: Cast or ductile iron, lug ends, stainless steel stem, extended neck.
 2. Disc: Stainless steel
 3. Seat: Resilient replaceable EPDM
 4. Handle and Operator: Hand-wheel and gear drive. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.7 CHECK VALVES

- A. Horizontal Swing Check Valves:
 1. 2 inches and Smaller: MSS SP 80, class 150, bronze body and cap, bronze seat, Buna-N disc, solder ends.
 2. 2-1/2 inches and Larger: MSS SP 71, class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.
- B. Spring-Loaded Check Valves:
 1. 2 inches and Smaller: MSS SP 80, class 150 bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder ends.
 2. 2-1/2 inches and Larger: MSS SP 71, class 125, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

2.8 PIPE HANGERS AND SUPPORTS

- A. Refer to Section 22 05 29.

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2.9 PRESSURE GAGES

- A. Gage: ASME B40.1, UL 393 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 - 1. Case: Stainless steel.
 - 2. Bourdon Tube: Brass.
 - 3. Dial Size: 2 inch diameter.
 - 4. Mid-Scale Accuracy: 1 percent.
 - 5. Scale: Psi.

2.10 PRESSURE GAGE TAPS

- A. Ball Valve: Brass for 250 psi.
- B. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

2.11 STEM TYPE THERMOMETERS

- A. Thermometer: Adjustable angle, digital display, light powered, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
 - 1. Size: 7-inch case.
 - 2. Power source: Photovoltaic cells requiring 10 lux of illumination for operation.
 - 3. Display: 9/16 inch LCD, 4 digits, 1/10 degree resolution, switchable between F and C, updated every 10 seconds.
 - 4. Stem: Aluminum, 3/4 inch NPT, 3-1/2 inch long, with glass passivated thermistor.
 - 5. Range: Minus 40 to 300 degrees F (minus 40 to 150 degrees C)
 - 6. Accuracy: 1 percent or 1 degree F, whichever is greater

2.12 RELIEF VALVES

- A. Pressure Relief:
 - 1. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi, UL listed for fuel oil, capacities ASME certified and labeled.
- B. 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.

2.13 STRAINERS

- A. 2 inch and Smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. 1-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.
- C. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

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2.14 HOSE BIBS

- A. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, with hand wheel, integral vacuum breaker in conformance with ASSE 1011.

2.15 BACKFLOW PREVENTERS

- A. Reduced Pressure Principle Backflow Preventer:
 - 1. Comply with ASSE 1013, NSF/ANSI 61.
 - 2. Bronze body, with bronze internal parts and stainless steel springs.
 - 3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

PART 3 -- EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.

3.2 GENERAL

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- B. Provide flanges, union, and couplings at locations requiring servicing. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- C. Use gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Use globe valves for throttling, bypass, or manual flow control services.
- E. Use spring loaded check valves on discharge of hot water pumps.
- F. Use butterfly valves in heating water systems interchangeably with gate and globe valves.
- G. Use lug end butterfly valves to isolate equipment.
- H. Use 3/4 inch ball valves with hose end adapter and cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- I. Flexible Connectors: Use at or near pumps where piping configuration does not absorb vibration.

3.3 INSTALLATION

- A. Thermometers and Gages:
 - 1. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
 - 2. Install gage taps in piping.
 - 3. Install pressure gages with pulsation dampers. Provide valve to isolate each gage.
 - 4. 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.

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5. Provide instruments with scale ranges selected according to service with largest appropriate scale.
 6. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
 7. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- B. Hangers and Supports:
1. Install hangers and supports according to Section 22 05 29.
- C. Aboveground Piping:
1. Install non-conducting dielectric connections wherever jointing dissimilar metals.
 2. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
 3. Group piping whenever practical at common elevations.
 4. Slope piping and arrange systems to drain at low points.
 5. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 29.
 6. 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.
 7. Provide access where valves and fittings are not accessible.
 8. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
 9. Provide support for utility meters according to requirements of utility companies.
 10. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 97 00.
 11. Install domestic and utility water piping according to ASME B31.9.
 12. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 00.
 13. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Use UL or FM approved flexible firestop sealant, installed per manufacturer's instructions.
 14. Install unions downstream of valves and at equipment or apparatus connections.
 15. Install valves with stems upright or horizontal, not inverted.
 16. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
 17. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
 18. Install globe valves for throttling, bypass, or manual flow control services.
 19. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
 20. Provide spring-loaded check valves on discharge of water pumps.
 21. Provide flow controls in water circulating systems as indicated on drawings.
 22. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

23. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
24. Test backflow preventers according to ASSE 5013.
25. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to washing machine outlets.
26. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

3.4 FIELD QUALITY CONTROL

- A. Test domestic water piping system according to applicable code

3.5 CLEANING

- A. Flush system to remove traces of flux or other materials.

3.6 DISINFECTION OF DOMESTIC WATER SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
- D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L. Neutralize disinfectant and dispose of disinfecting water in accordance with ADEC regulations.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze according to AWWA C651.

END OF SECTION

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

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SECTION 22 11 19 – PIPING AND TUBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Stainless steel pipe.
 - 2. Stainless steel tubing.
 - 3. Isolation valves.
 - 4. Manifolds
 - 5. Pipe supports

1.2 THE REQUIREMENT

- A. The CONTRACTOR shall furnish and install all exposed piping and tubing as shown and specified, complete, including stainless steel pipe and tubing, fittings, valves, bolts, supports, insulating connections, manifolds, and such other specialties as required for a complete and operable piping system in accordance with the requirements of the Contract Documents.
- B. All items shall be manufactured from stainless steel.

1.3 CONTRACTOR SUBMITTALS

- A. For the materials and equipment items supplied under the provisions of this Section, the CONTRACTOR shall submit copies of the manufacturer's product specifications.

PART 2 - PRODUCTS

2.1 STAINLESS STEEL PIPE

- A. All mounting nipples for gauges, instruments and other appurtenances shall be stainless steel, Type 316 Schedule 80 threaded pipe conforming to ASTM A 312 with stainless steel threaded fittings.

2.2 STAINLESS STEEL TUBING

- A. All instrument sensing lines shall be stainless steel tubing. Stainless steel tubing shall be seamless 316L stainless steel tubing meeting ASTM A213, ASME SA-213 specifications with a minimum wall thickness of 0.049 inches. All fittings shall be compression, guaranteed gas bubble-tight as Manufactured by **Swagelok**, or equal.

2.3 ISOLATION VALVES

- A. All instrument isolation valves shall be ball valves, 316 stainless steel, **Swagelok 40 Series**, or equal.

SECTION 22 11 19 – PIPING AND TUBING SYSTEMS

2.4 THREE VALVE INSTRUMENT MANIFOLDS

- A. All instrument manifolds shall be 316 stainless steel, **Swagelok V Series 3-Valve Manifold** or equal.

2.5 PIPE SUPPORTS

- A. Pipe supports, hangers, anchors, and guides shall be compatible with the pipe or tubing materials. Tubing supports shall include a rubberized insert to provide corrosion protection and vibration dampening, **Cush-A-Clamp** system or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Supports: Pipe and tubing systems shall be securely anchored and supported to prevent undue deflection or vibration in accordance with the applicable codes and standards. Provide all hangers, supports, guides, anchors, bolts, and mounting accessories as required for the installation. Maximum spacing between supports shall be 4 feet for all tubing.
- B. Piping: Individual tubes shall run parallel and near the surfaces from which they are supported. Bends shall be formed to uniform radii with the proper tool without deforming or thinning the walls of the tubing. Tube bending with knees or without tooling is not permitted. Ends of tubing shall be square-cut and cleaned before being inserted in the fittings. Bulkhead fittings shall be provided at all panels requiring pipe or tubing entries.
- C. Isolation Valves: All instrument mounting nipples and sensing lines shall be provided with isolation valves at the pipe tap.
- D. Instrument Manifolds: All pressure transmitters shall be provided with instrument manifolds for testing and calibration. All manifolds shall be independently supported. Differential pressure elements shall have three valve manifolds.
- E. Piping Taps: All piping taps shall be made at the horizontal centerline of the pipe to minimize the introduction of air into the sensing lines. Instruments shall be mounted vertically. All taps shall include an isolation valve.
- F. Air Traps: All tubing shall be installed to avoid air traps and allow air to be bled off. In general, tubing shall be routed to provide a continuous rise from the tap to the instrument.
- G. Tubing Tags: All tubing lines shall be identified at the tap with a stamped, stainless steel tag wired to the tap.

END OF SECTION

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Sanitary sewer piping buried within 5 feet of building.
 2. Sanitary sewer piping above grade.
 3. Unions and flanges.
 4. Valves.
 5. Pipe hangers and supports.
 6. Floor drains.
 7. Cleanouts.
 8. Bedding and cover materials.

1.2 SUBMITTALS

- A. Product Data:
1. Piping: Pipe materials, fittings, and accessories. Submit manufacturers catalog information.
 2. Valves: Manufacturers catalog information with valve data and ratings for each service.
 3. Hangers and Supports: Manufacturers catalog information including load capacity.
 4. Sanitary Drainage Specialties: Manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
 5. Pumps: Pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve. Include electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions: Material and equipment.
- C. Manufacturer's Certificate: Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

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

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 -- PRODUCTS

2.1 SANITARY SEWER PIPING, ABOVE GRADE

- A. ABS Pipe: ASTM D2661 or ASTM F628, cellular core
1. Fittings: ABS, ASTM D2661.

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

2. Joints: ASTM D2235, solvent weld.

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Copper Piping: Class 150, bronze unions with soldered joints.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
3. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Copper Piping: Class 150, slip-on bronze flanges.
2. PVC Piping: PVC flanges.
3. HDPE Piping: 150# HDPE Flanges
4. Gaskets: 1/16 inch thick preformed neoprene gaskets.

- #### C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to MNPT screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.3 PUMP DISCHARGE CHECK VALVES

A. Manufacturers:

1. Flygt.
2. Substitutions: Permitted.

- #### B. Flanged body cast-iron non-clog ball type check valve. Ball shall be sinking type coated with vulcanized nitrile rubber. Valve shall have removable bolted cover for servicing without removal of the valve body.

2.4 PLUG VALVES

A. Manufacturers:

1. Homestead.
2. Substitutions: Permitted.

- #### B. 3 inches and larger: AWWA C517, 150 psi F ASTM A126, Class B, cast iron body, bonnet and plug. Elastomer coated plug. Replaceable upper and lower bearings of permanently lubricated 316 stainless steel. lever handle, EPDM stem seals, welded 95% nickel seats, full port, with Class 125 flanged ends.

2.5 PIPE HANGERS AND SUPPORTS

- #### A. Refer to Section 22 05 29.

2.6 FLOOR DRAINS

A. Manufacturers:

1. J.R. Smith.

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

2. Substitutions: Permitted.
- B. Floor Drains: ASME A112.21.1; lacquered cast-iron two-piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer, sediment baskets as indicated on the drawings.

2.7 CLEANOUTS

- A. Manufacturers:
 1. J.R. Smith.
 2. Substitutions: Permitted.
- B. Interior Finished Floor Areas: Lacquered cast iron body with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.
- C. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless-steel access cover secured with machine screw.
- D. Interior Unfinished Accessible Areas: Threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 -- EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Aboveground Piping:
 1. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
 2. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
 3. Encase exterior cleanouts in concrete flush with grade.
 4. Install floor cleanouts at elevation to accommodate finished floor.
 5. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
 6. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
 7. Install piping to maintain headroom. Do not spread piping, conserve space.
 8. Group piping whenever practical at common elevations.
 9. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 00.

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

10. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.
11. Provide access where valves and fittings are not accessible.
12. Install piping penetrating roofed areas to maintain integrity of roof assembly.
13. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
14. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 97 00.
15. Install bell and spigot pipe with bell end upstream.
16. Sleeve pipes passing through partitions, walls and floors.
17. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Use UL or FM approved flexible firestop sealant, installed per manufacturer's instructions.
18. Support cast iron drainage piping at every joint.

3.4 FIELD QUALITY CONTROL

- A. Test sanitary waste and vent piping system according to Uniform Plumbing Code.

END OF SECTION

SECTION 22 14 29 - SUMP PUMPS

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes: Sump pumps

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Installation details for pumps, piping, controls and accessories including wiring schematics.
- B. Product Data: Specified Products.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with 10 years' experience.
- B. Installer: Company specializing in performing Work of this Section with 3 years' experience.

PART 2 -- PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

- A. Manufacturers:
 - 1. Zoeller
 - 2. Substitutions: Permitted
- B. Pump Characteristics:
 - 1. Impeller: Cast iron, non-clogging vortex
 - 2. Casing: Cast iron, finned for cooling with powder coated epoxy finish. Provide stainless steel lifting handle
 - 3. Double Mechanical Seal: Carbon & ceramic with stainless steel wetted parts. Lower seal cavity oil filled.
 - 4. Shaft: Stainless steel.
- C. Pump Motors
 - 1. Fully submerged hermetically sealed, NEMA B design induction motor. Service Factor of 1.15 minimum.
 - 2. Class H insulation rated for 180 degrees C.
 - 3. Power Cable: Severe duty rated, oil and water resistant, epoxy seal on motor end. Minimum of 10 foot length.
- D. Controls
 - 1. Float controls: Bulb type float switch.

SECTION 22 14 29 - SUMP PUMPS

PART 3 -- EXECUTION

3.1 EXAMINATION

- A. Verify connections, size, and location are as indicated on Drawings.

3.2 INSTALLATION

- A. Provide necessary piping, fittings, and valves as indicated on Drawings.
- B. Provide stainless steel lifting cable attached to the pump with loop or ring at the upper end, secured to a hook just below the top of the pump basin.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation, examine, adjust and test each pump for proper operation.
- B. Test each pump with clean water through minimum of four complete cycles.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Provide services of manufacturer's representative for period of not less than 1 day to inspect installations and for performance testing.

END OF SECTION

SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric on-demand tempered water heaters.

1.2 SUBMITTALS

- A. Product Data: Dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.
- B. Manufacturer's Installation Instructions: Mounting and support requirements.

1.3 WATER QUALITY MAINTENANCE

- A. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.
- B. All piping, equipment, and components in contact with potable water, including, but not limited to, tanks, pumps, piping, valves, fittings and instrumentation, shall be ANSI/NSF-61 approved unless otherwise approved by ADEC. Materials in direct contact with drinking water shall be lead free in accordance with the "Reduction of Lead in Drinking Water Act":
 - 1. Not containing more than 0.2 percent lead when used with respect to solder and flux; and
 - 2. 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.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 -- PRODUCTS

1.1 RESIDENTIAL ELECTRIC WATER HEATERS

- A. Type: Automatic, electric, wall-hung, on-demand, tempered water
- B. Capacity: None / on-demand.
- C. Heater Element: Nickle-chrome.
- D. Controls: Automatic water thermostat with non-adjustable maximum temperature of 90 degrees F.
- E. Ratings: NSF/ANSI 372, ANSI Z358.1

PART 3 -- EXECUTION

1.1 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Connect domestic cold water piping to supply and return water heater connections.
- C. Install discharge piping from relief valves and drain valves to nearest floor drain.
- D. Install water heater trim and accessories furnished loose for field mounting.
- E. Install electrical devices furnished loose for field mounting.

SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

- F. Install control wiring between water heater control panel and field mounted control devices. Support cables and conduit per NEC and local codes.

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 air systems.
 - 2. Testing, adjusting, and balancing of hydronic systems.

1.2 SUBMITTALS

- A. Draft Reports: Submit for review prior to final acceptance of Project.
- B. Test Reports: Submit prior to final acceptance of Project and for inclusion in operating and maintenance manuals. Assemble in soft cover, letter size, 3-ring binder, with table of contents page and tabs, and cover identification. Include reduced scale drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alaska standards.
- B. Report Forms: AABC MN-1 National Standards for Total System Balance forms OR NEBB forms.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 EXAMINATION

- A. Before starting work, verify systems are complete and operable.
- B. Report defects, deficiencies, or abnormal conditions in mechanical systems preventing system balance.
- C. Beginning of work means acceptance of existing conditions.

3.2 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.3 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to deliver design supply, return, and exhaust air quantities within previously stated tolerances.
- B. Make air flow rate measurements in ducts by traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Change volume using dampers mounted in ducts.

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

- E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes to accomplish system air flow. Vary branch air quantities by damper regulation.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Allow for pressure drop equivalent to 50 percent loading of filters.
- G. Measure static air pressure differential between screens room and adjoining areas.
- H. Adjust automatic outside air, return air, and exhaust air dampers for design conditions.
- I. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.
- J. At modulating damper locations, take measurements and balance at extreme conditions.

3.4 WATER SYSTEM PROCEDURE

- A. Adjust water systems after air balancing to deliver design quantities within previously stated tolerances.
- B. Use calibrated fittings or equipment and pressure gages to determine flow rates for system balance. Where not installed, base flow balance on temperature difference across heat transfer elements.
- C. Change system balance with automatic control valves fully open to heat transfer elements.
- D. Change adjustment of water distribution systems by means of balancing cocks, valves, and fittings.

3.5 FIELD QUALITY CONTROL

- A. Verify recorded data represents actually measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Duct Materials.
 - 2. Ductwork fabrication.
 - 3. Ductwork accessories.
 - 4. Balancing Dampers
 - 5. Duct Flowswitches

1.2 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission.

1.3 SUBMITTALS

- A. Shop Drawings: Duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
 - 1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other Work.
 - 2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this Section.
 - 3. Fittings.
 - 4. Reinforcing details and spacing.
 - 5. Seam and joint construction details.
 - 6. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- B. Product Data: Duct materials.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

- A. Perform Work according to SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A and NFPA 90B standards.
- C. Passivate stainless steel welds per ASTM A967. Confirm absence of free iron in heat affected zone using ASTM A967, Copper Sulfate Test, Practice C.

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 -- PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A90/A90M.
- B. Stainless Steel Ducts: ASTM A240, Type 304 or ASTM A666, Type 304L where fabrication is by welding.
- C. Fasteners: Stainless steel bolts, or stainless steel sheet metal screws.
- D. Hanger Rod: ASTM F593; stainless steel, threaded both ends, threaded one end, or continuously threaded. Zinc plated hardware will not be accepted.

2.2 DUCTWORK FABRICATION

- A. General:
 - 1. Fabricate and support rectangular ducts according to SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
 - 2. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
 - 3. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
 - a. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
 - b. Do not provide sealing products not bearing UL approval markings.

2.3 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate according to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Approximately 4 inches wide.
 - 3. Metal: 3 inch wide, 24 gage galvanized steel.

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

2.4 BALANCING DAMPERS

- A. Fabricate according to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
 - 1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.
 - 2. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings.
 - 3. Quadrants:
 - a. Furnish locking, indicating quadrant regulators.
 - b. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.

2.5 DUCT FLOWSWITCHES

- A. Vane or paddle type flowswitch, stainless steel element, field adjustable length.
 - 1. Suitable for vertical duct flow
- B. SPDT snap switch, 125VAC, 9.8 amps full load

PART 3 -- EXECUTION

3.1 EXAMINATION

- A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

- A. Install and seal ducts according to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Install duct hangers and supports as required.
- D. Use double nuts and lock washers on threaded rod supports.
- E. Exhaust Outlet Locations:
 - 1. Minimum Distance from Building Openings: 3 feet.
 - 2. Minimum Distance from Outside Air Intakes: 10 feet.

3.3 SCHEDULES

- A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Odor Control Exhaust	Galvanized Steel

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply	1 inch w.g., regardless of velocity
Return and Relief	1/2 inch w.g. regardless of velocity.
General and Odor Control Exhaust	1 inch w.g., regardless of velocity.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Inline Centrifugal Fans – Roof Mounted Upblast

1.2 SUBMITTALS

- A. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork, and accessory connections.
- B. Product Data: Each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Fan manufacturer's instructions.
- D. Manufacturer's Certificate: Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 211 and 311 and bear AMCA Certified Rating Seal.
- B. Spark Resistant Construction: Conform to AMCA 99.
- C. UL Compliance: UL listed and labeled, designed, manufactured, and tested according to UL 705.
- D. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication and indicate on Shop Drawings.

PART 2 -- PRODUCTS

2.1 INLINE CENTRIFUGAL FANS

- A. Manufacturers:
 - 1. Greenheck
 - 2. Substitutions: Permitted.
- B. Wheel and Inlet:
 - 1. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, back plate, backward curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
- C. Housing:
 - 1. Aluminum, continuously welded, designed to minimize turbulence with spun inlet bell and shaped cut-off.

SECTION 23 34 00 - HVAC FANS

2. Factory finish before assembly to manufacturer's standard.
- D. Bearings and Sleeves:
1. Bearings: Pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9 L-10 life at 100,000 hours.
 2. Shafts: Hot rolled steel, ground and polished, with key way, protectively coated with lubricating oil, and shaft guard.
- E. Accessories:
1. Access Doors: Quick opening latches and gaskets.
 2. Roof Curb: Galvanized steel, continuously welded seam, high wind rated, seismic zone rated
- F. Motor:
1. Direct drive
 2. AC Induction – Inverter Duty
 - a. Totally Enclosed Fan Cooled Enclosure, permanently lubricated, heavy duty ball bearing type

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Install fan on roof curb rated for high wind and seismic zones. Follow manufacturer's instructions for curb and fan installation. Seal roof curb and replace any cuts made to roof membrane.

3.2 CLEANING

- A. Vacuum clean inside of fan cabinet.

3.3 DEMONSTRATION

- A. Demonstrate fan operation and maintenance procedures.

3.4 PROTECTION OF FINISHED WORK

- A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Diffusers.
2. Grilles.
3. Louvers.

1.2 SUBMITTALS

- A. Product Data: Sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of air outlets and inlets.

PART 2 -- PRODUCTS

2.1 WALL SUPPLY REGISTERS/GRILLES

A. Manufacturers:

1. Titus.
2. Tuttle & Bailey.
3. Substitutions: Permitted.

- B. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.

- C. Frame: 1 inch margin with countersunk screw mounting and gasket.

- D. Fabrication: Aluminum with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel baked enamel finish.

- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.2 SUPPLY REGISTERS/GRILLES – DRUM LOUVER STYLE

A. Manufacturers:

1. Titus.
2. Tuttle & Bailey.
3. Substitutions: Permitted.

- B. Type: Drum style with streamlined and individually adjustable aluminum vanes mounted in a heavy gauge extruded aluminum drum, 3/4 inch maximum spacing with spring or other device to set blades, drum rotation 25 degrees above and below horizontal.

- C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

SECTION 23 37 00 - AIR OUTLETS AND INLETS

- D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.3 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:

1. Titus.
2. Substitutions: Permitted.

- B. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, zero degree fixed deflection, horizontal face.

- C. Frame: 1 inch margin with countersunk screw mounting.

- D. Fabrication: Aluminum with 20 gage minimum frames and 22 gage minimum blades, with factory off-white baked enamel finish, color to be selected.

- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.4 LOUVERS

A. Manufacturers:

1. Ruskin.
2. Greenheck.
3. Substitutions: Permitted.

B. Product Description:

1. Stationary, drainable.

- C. Type: 4 inch deep with blades on 45 degree slope, heavy channel frame.

- D. Fabrication: 16 gage thick galvanized steel or 12 gage thick extruded aluminum, welded assembly, with factory fluoropolymer spray finish, color to be selected.

- E. Mounting: Furnish with exterior angle flange for installation

- F. Bird Screen: Bird screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

PART 3 -- EXECUTION

3.1 EXAMINATION

- A. Verify inlet and outlet locations.
- B. Verify ceiling and wall systems are ready for installation.

3.2 INSTALLATION

- A. Install diffusers to ductwork with airtight connection.
- B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 31 00.

SECTION 23 37 00 - AIR OUTLETS AND INLETS

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

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SECTION 23 82 39 – UNIT HEATERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric Unit Heaters – Ordinary Locations

1.2 SUBMITTALS

- A. Product Data: Submit schedules for equipment and radiation enclosures indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output of equipment. Submit coil and frame configurations, and rough-in dimensions.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit operating instructions, maintenance and repair data, and parts lists.

PART 2 PRODUCTS

1.1 ELECTRIC UNIT HEATERS – ORDINARY LOCATIONS

- A. Manufacturers:
 - 1. Modine.
 - 2. Q-Mark.
 - 3. Substitutions: Permitted.
- B. Coils: Nickel-chromium wire elements.
- C. Casing: 0.0478 inch thick steel with threaded pipe connections for hanger rods.
- D. Finish: Factory applied baked enamel of manufacturer's standard color. Where called out on the schedule, provide phenolic coating of entire unit.
- E. Fan: Direct drive propeller type with fan guard.
- F. Air Outlet: Horizontal louvers on horizontal throw models.
- G. Motor: Permanently lubricated sleeve bearings. Totally enclosed, continuous-duty rated.
- H. Control: Factory installed thermostat.

PART 3 EXECUTION

1.1 INSTALLATION

- A. Install unit heaters from building structure. Support independently from electrical connections. Mount minimum 7 feet 6 inches above floor.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 23 82 39 – UNIT HEATERS

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SECTION 25 14 05 – ELECTRICAL AUTOMATION AND TERMINAL DEVICES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide complete instrumentation, meters, transducers, relays, detectors, and switches as indicated on the electrical drawings, control diagram, herein, or in other Sections of the Specifications.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Local control panels shall comply with the requirements of NEC, NEMA, and shall be built to UL-508 standards, or equal as approved by the City and Borough of Juneau.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with 26 05 00 – Electrical Work, General.
 - 1. Include panel schematics and layout drawings, and catalog cuts of all control equipment including enclosures, relays, pilot devices, terminations, and wire troughs.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. The CONTRACTOR shall provide the instrumentation and auxiliary devices to satisfy the functional requirements in the relevant mechanical equipment and Instrumentation & Control specifications and the Electrical Schematics. Each station shall be fabricated with UL-labeled components. Stations not specifically indicated as being WORK of other Sections shall be provided under this Section. All stations shall be wired under this Section.
- B. The controls shall be 120-volt maximum, preferably 24 VDC. Where the electrical power supply is 240-volt, single-phase or 480-volt, 3-phase, the station shall be provided with a fused control power transformer. Control conductors shall be provided in accordance with Section 26 05 00 – Electrical Work, General.
- C. Each device shall be provided with identified terminal strips for the connection of external conductors. The CONTRACTOR shall provide sufficient terminal blocks to connect 25 percent additional conductors for future use. Termination points shall be identified in accordance with Shop Drawings. The stations shall be the source of power for all 24 VDC/120 VAC solenoid valves interconnected with the stations. All equipment associated with the stations shall be ready for service after connection of conductors to equipment, controls, and stations.
- D. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.
- E. Enclosures

SECTION 25 14 05 – ELECTRICAL AUTOMATION AND TERMINAL DEVICES

1. In indoor rooms, enclosures shall be NEMA 12 steel enclosures painted with ANSI 61 exterior and white interior.
2. In outdoor areas and underground locations, enclosures shall be NEMA 4X stainless steel (prior to modifications) with brushed finish. Where possible, penetrations shall be made in such a manner as to maintain the NEMA 4X rating. If this is not possible, the penetrations shall be made in such a manner as to minimize entry of foreign materials into the enclosure.
3. Through the door disconnects are not permitted.
4. Enclosures shall be freestanding, pedestal-mounted, or equipment skid-mounted, as indicated. Internal control components shall be mounted on a removable mounting pan. Mounting pan shall be finished white.
5. Enclosures shall have non-locking handles.

2.2 ELECTRONIC POWER MONITOR

- A. The electronic power monitor shall measure 3-phase power, power factor, current, voltage, voltage unbalance, frequency, demand, and Volt-Amp-reactive power. The meter shall have a two-element connection, a two-and-one-half-element connection, and a three-element connection. The meter shall provide an EtherNet output and a door-mounted display module. Power supply shall be 24 VDC. The monitor package shall include (3) split ring CTs for single-phase service and (4) split ring CTs for three-phase services. The meter shall be an **Allen-Bradley Bulletin 1426-M5E**, or equal. Provide the following power monitors:

Tag No.	Location
PM - 100	Outer Drive - MCC
PM - 100	West Juneau - MCC

2.3 DC SYSTEM VOLTAGE TRANSDUCER

- A. The DC system voltage transducer shall provide a 4-20 mA output, fully isolated from input, proportional to a 0-50 VDC input. Supply voltage shall be 24 VDC. The transducer shall provide accuracy of 0.5% of span with a 250 ms response time.
- B. Manufacturer: **CR Magnetics CR5320-50**, or equal.
- C. Install DC system voltage transducers as shown on the panel wiring diagrams.

2.4 MISCELLANEOUS DEVICES

- A. Intrusion Detection Switches:
1. Industrial limit switch and lever arm, **Allen-Bradley 802T-HP switch with 802MC-W2B lever arm**, or equal.
 2. Provide the following intrusion detection switches:

Tag No.	Location
ZS-100	OD - Main Entrance
ZS-100	WJ - Main Entrance

SECTION 25 14 05 – ELECTRICAL AUTOMATION AND TERMINAL DEVICES

- B. Smoke Detectors: Smoke detectors are to be **GE Interlogix ESL 500N Series, Model 541NCRXT**, or equal. Provide the following devices:

Tag No.	Location
BS – 100 thru 104	Outer Drive
BS – 100 thru 104	West Juneau

- C. Flood Detectors: Flood detection is to be accomplished utilizing single-level liquid level sensors that employ hermetically sealed magnetic reed switch technology. The detector is to have a float made from Burna-N that rides up and down a brass stem. The ‘normally closed’ switching contact is to be rated at 24 VDC, 0.5 A. Flood detectors are to be **Madison M Series model M4300**, or equal. Provide the following flood detectors:

Tag No.	Location
LAHH - 101	OD – Pump Level
LAHH - 101	WJ – Pump Level

- D. Valve Limit Switches: Valve off-seat limit switches shall be single-pole double-throw, **Claval X105LCW**, or equal, compatible with the type of valve. Provide a complete assembly, including rising stem, bushing, mounting bracket, adjustable locking collar, and mechanical modifications required for installation.
- E. Pump Protection Modules: The pumps shall be equipped with a Pump Electronic Module (PEM) with sensors mounted inside the motor. A Base Unit (FLYGT MAS 812 BU) shall collect, store and digitize all measurement from all sensors and shall communicate the data in a digital format via control leads and send these signals to the Control Unit (FLYGT MAS 801 CU). A touch screen display (FLYGT FOP) shall be provided at the MCC for display of pump protection data and alarms generated from the pumps. The Base Units and Control Unit modules shall be a UL-listed for the installation in the Motor Control Center (MCC).

Pump Station	Pumps
Outer Drive	Pumps P-101, 102, 103
West Juneau	Pumps P-201, 202

PART 3 -- EXECUTION

3.1 PRODUCT HANDLING

- A. Special Instructions: Special instructions for proper field handling, storage, and installation required by the manufacturer shall be securely attached to each piece of equipment prior to packaging and shipment.
- B. Tagging: Each component shall be tagged to identify its location, instrument tag number, and function in the system. A permanent stainless-steel tag firmly attached and stamped with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment in the PCIS. Identification should be prominently displayed on the outside of the package.

SECTION 25 14 05 – ELECTRICAL AUTOMATION AND TERMINAL DEVICES

- C. Storage: Equipment shall not be stored outdoors. Equipment shall be stored in dry, permanent shelters, including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the CONTRACTOR. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through tests as directed by the ENGINEER. If such tests reveal defects, the equipment shall be replaced.

3.2 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 locations 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 26.

C. Instrumentation Tie-Downs: Instruments, control panels, and equipment shall be anchored by methods that comply with seismic requirements applicable to the Site.

D. Existing Instrumentation: Each Existing instrument to be removed and reinstalled shall be cleaned, reconditioned, and recalibrated by an authorized service facility of the instrument manufacturer. The CONTRACTOR shall provide certification of this work prior to reinstallation of each instrument.

E. 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.

F. Installation Criteria and Validation: Field-mounted components and assemblies shall be installed and connected according to the requirements below:

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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. Connections shall be, as 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. Mounting stands and bracket materials and workmanship shall only comply with requirements of the Contract Documents.
10. Verify the correctness of each installation, including polarity of electrical 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.
11. The OWNER will not be responsible for any additional cost of rework attributable to actions of the CONTRACTOR or the PANEL FABRICATOR.

3.3 CALIBRATION

1. General: Devices provided under Division 40 shall be calibrated according to the manufacturers' recommended procedure to verify operational readiness and ability to meet the indicated functional and tolerance requirements.
2. Field Calibration: Instruments that were not bench-calibrated shall be calibrated in the field to ensure proper operation in accordance with the instrument loop diagrams or specification data sheets.

3.4 LOOP TESTING

- A. The CONTRACTOR shall coordinate with and assist the PANEL FABRICATOR and to complete the various control panel loop testing.
- 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 controller. Actual

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signals shall be used wherever available. Following any necessary corrections, the loops shall be retested.

3.5 PERFORMANCE TEST

- A. The CONTRACTOR shall assist and coordinate with the PANEL FABRICATOR during the complete start-up, testing and commissioning process. The CONTRACTOR shall provide proper qualified personnel to make adjustments, assist with troubleshooting, provide technical support, etc. as necessary during the commissioning process.
- B. The entire PCIS hardware, field instruments, power supplies, and wiring shall operate for 30 days without failure.
- C. The CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.
- D. 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.

3.6 FINAL ACCEPTANCE TEST

- A. Once all equipment and subsystem tests have been complete and results accepted by the ENGINEER, the complete PCIS system shall be put into service for a Final Acceptance Test. The OWNER and ENGINEER shall be notified a minimum of 48 hours prior to the start of the test.
- B. The entire PCIS system control panels hardware, field instruments, power supplies, and wiring shall operate in accordance with the Specifications and Functional Narrative for 30 days without failure.
- C. If any component, other than field instruments, fails during the final acceptance test, it shall be repaired or replaced and the PCIS shall be restarted for another 30-day period.
- D. The CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.

3.7 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

- A. For the purpose of this Section, the following 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.

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8. Debris associated with the 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 25 14 05 – ELECTRICAL AUTOMATION AND TERMINAL DEVICES

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SECTION 26 01 26 – ELECTRICAL TESTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. This Section specifies the WORK necessary to test, commission, and demonstrate that the electrical WORK satisfies the criteria of these Specifications and functions as required by the Contract Documents.
- B. The requirements of Section 26 05 00 – Electrical Work, General, apply to the WORK of this Section.

1.2 TESTING

- A. The following test requirements supplement test and acceptance criteria that may be stated elsewhere.
 - 1. Lighting: Switching, including remote control, if indicated. Circuitry is in accordance with panel schedules.
 - 2. Power Instrumentation: Demonstrate that power monitor, power monitoring, current monitoring, and voltage monitoring is functional.
 - 3. Demonstrate mechanical and/or electrical interlocking by attempting to subvert the intended sequence.
 - 4. Activate ground fault tripping by operating test features provided with ground current protective systems and by injecting a known and reasonable current in the ground current sensor circuit. In general, ground fault tripping should occur at a ground current equivalent to 20 percent of phase current. Current injection is not required of circuit 400 amps or less.
 - 5. Cable Testing: power circuits shall be tested for insulation resistance with a 1000-volt megohm meter. Testing shall be done after the equipment is terminated. Control and signal wires shall be tested for continuity and resistance to ground.
 - 6. Test Ground Fault Interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.
 - 7. A functional test and check of all electrical components is required prior to performing subsystem testing and commissioning. Compartments and equipment shall be cleaned as required by other provisions of these Specifications before commencement of functional testing. Functional testing shall comprise:
 - a. Visual and physical check of cables, circuit breakers, transformers and connections associated with each item of new and modified equipment.
 - b. Circuit breakers that have adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field-adjusted by a representative of the circuit breaker manufacturer. Setting shall be tabulated and proven for each circuit breaker in its installed position. Test results shall be certified by the person performing the tests and be transmitted to the ENGINEER.
 - 8. Complete ground testing of grounding electrodes per requirements prior to operating the equipment.

SECTION 26 01 26 – ELECTRICAL TESTS

- B. Sub-system testing shall occur after the proper operation of alarm and status contacts has been demonstrated or otherwise accepted by the ENGINEER and after process control devices have been adjusted as accurately as possible. It is intended that the CONTRACTOR will adjust limit switches and level switches to their operating points prior to testing and will set pressure switches, flow switches, and timing relays as dictated by operating results.
- C. After initial settings have been completed, each subsystem shall be operated in the manual mode and it shall be demonstrated that operation is in compliance with the Contract Documents. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify such items as proper start and stop sequence of pumps, proper operation of valves, proper speed control, etc.
- D. Motor operated valves shall be tested after having been phased and tested for correct motor rotation and after travel and torque limit switches have been adjusted by a representative of the valve manufacturer. Tests shall verify status indication, proper valve travel, and correct command control from local and remote devices.
- E. Provide ground resistance tests on the main grounding bars in all control panels in the presence of the ENGINEER and submit results.
- F. Subsystems shall be defined as individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, etc.
- G. General: Carry out tests indicated herein for individual items of materials and equipment in other Sections.
- H. Megger each complete phase wire, cable, termination, and submersible pump winding to ground.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall 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. 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. The CONTRACTOR shall develop a work plan clearly indicating how temporary power and controls/SCADA will be provided/maintained to this Facility within the prescribed work and outage parameters of this section.
- E. Concrete, excavation, backfill, and steel reinforcement required for encasement, 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, including duct banks, manholes, handholes, equipment housekeeping pads, and light pole bases.

1.2 REFERENCE STANDARDS

- A. The WORK of this Section and all sections in Division 26 shall comply with the following, as applicable:
 - NEC (NFPA 70) National Electrical Code, latest adopted edition
 - NETA International Electrical Testing Association
 - NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

City and Brough of Juneau adopted Electrical Code amendments to the NEC.
- B. Electrical equipment shall be listed by and shall bear the label of Underwriters' Laboratories, Inc. (UL), or another suitable third-party listing agency recognized by the State of Alaska Mechanical Inspections Division.
- C. Installation of electrical equipment and materials shall 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 shall govern.

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

1.3 SIGNAGE

- A. Local Disconnect Switches:
 - 1. Each local disconnect switch for motors and equipment shall 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 shall be marked with conspicuous signs prohibiting entry by unqualified persons.
- C. Isolating Switches: Isolating switches not interlocked with an approved circuit interrupting device shall be provided with a sign warning against opening them under load.

1.4 PUBLIC UTILITIES REQUIREMENTS

- A. The CONTRACTOR shall contact the serving utility and verify compliance with requirements before construction. The CONTRACTOR shall coordinate schedules and payments for work by all utilities.
- B. Electrical service shall be as indicated and be as required by the serving utility, Alaska Electric Light and Power (AEL&P).
- C. The CONTRACTOR shall verify and provide all service conduits, fittings, grounding devices, and all service wires not provided by the serving utility.
- D. The CONTRACTOR shall verify with the utility the exact location of each service point and type of service, and shall pay all charges levied by the serving utilities as part of the WORK.

1.5 PERMITS AND INSPECTION

- A. All electrical permits shall be obtained and inspection fees shall be paid by the CONTRACTOR.
- B. The CONTRACTOR shall pay all connection and turn-on service charges required by the utility company.

1.6 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Division 01 of the project specifications.
- 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.

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

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 shall be stamped to indicate the project name, applicable Section and paragraph, model number, and options. This information shall be marked in spaces designated for such data in the ENGINEER's stamp.
- C. Shop Drawings shall be custom prepared. Drawings or data indicating "optional" or "as required" equipment are not acceptable. Options not proposed shall be crossed out or deleted from Shop Drawings.
- D. Materials and Equipment Schedules: The CONTRACTOR shall 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 shall 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 MASS Section 10.04, Article 4.20 Operating and Maintenance Manuals.
- F. Record Drawings: The CONTRACTOR shall show invert and top elevations and routing of all duct banks and concealed below-grade electrical installations. Record Drawings shall be prepared, be available to the ENGINEER, and be submitted according to MASS Section 10.05 Article 5.6.
- G. Equipment Summary Sheets: The CONTRACTOR shall provide Electrical Equipment Summary Form 1302 CM 1207 for all electrical devices, panels, motor starters, and miscellaneous equipment. The data shall be provided in electronic format, **Microsoft Excel**, or approved equal.

1.7 AREA DESIGNATIONS

- A. General:
1. Raceway system enclosures shall comply with Section 26 05 33 – Electrical Raceway Systems.
 2. Electrical WORK specifically indicated in sections within any of the Specifications shall comply with those requirements.

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

3. Electrical WORK in above ground indoor facilities shall be NEMA 12, unless otherwise noted.
4. Electrical WORK in below ground facilities and outdoors shall be NEMA 4X.
5. Installations in hazardous locations shall conform strictly to the requirements of the Class, Group, and Division indicated.

B. Material Requirements:

1. NEMA 4X enclosures shall be stainless steel.
2. NEMA 12 enclosures shall be steel, coated with ANSI 61 grey paint.

1.8 TESTS

- A. The CONTRACTOR shall be responsible for factory and field tests required by specifications in Division 26 and by the ENGINEER or other authorities having jurisdiction. The CONTRACTOR shall 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 shall be submitted with the Shop Drawings, and factory performance test reports for custom-manufactured equipment shall be submitted and be approved prior to shipment. Field test reports shall be submitted for review prior to Substantial Completion.
- C. Equipment or material which fails a test shall be removed and replaced.

1.9 ELECTRICAL OUTAGE AND WORK PLAN

- A. The CONTRACTOR shall develop an 'Outage and Work Plan'. The plan shall clearly indicate how temporary service, power and controls/SCADA will be provided/maintained to this Facility within the prescribed work and outage parameters.
- B. The intent is for the CONTRACTOR to clearly define how they anticipate removing and installing the new power service, switchgear and control panel in the existing locations while maintaining a critical, functioning facility in continuous operation based on the outage parameters. The plan shall also indicate how feeder, branch and control (signal) circuits will be maintained during construction.
- C. The plan shall be provided as a written (MSWord) document including but not limited to the following:
 1. Description of temporary power and control systems.
 2. Description of construction sequence for temporary and new installations.
 3. Anticipated specific outage schedule in tabular format (system, outage frequency, duration of outage).
 4. Site plan / control room level floor plan sheet showing anticipated locations of temporary equipment.

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

- D. The plan shall be submitted for approval no later than 30 days prior to beginning work. Electrical and controls work shall not proceed until this plan has been submitted and approved by the ENGINEER.

1.10 DEMOLITION AND RELATED WORK

- A. The CONTRACTOR shall perform electrical demolition WORK as indicated on the electrical drawings and in parts of this Specification Section. The CONTRACTOR is cautioned that demolition WORK may also be indicated on non-electrical drawings. Coordinate electrical de-energization, disconnection, and removal with all trades and the overall sequence of construction.
- B. Electrical requirements associated with removed equipment shall be:
 - 1. Remove control and signal wiring as indicated.
 - 2. Remove all abandoned raceways. Encased conduits shall be cut flush to the floor and be grouted.
 - 3. Remove remote mounted starters, disconnect switches, circuit breakers, sensors, and transmitters.
 - 4. Remove remote mounted status lights and switches where indicated on the electrical drawings, and blank off openings in existing panels with field-fabricated stainless steel plates. Plates shall be attached with stainless steel finish screws.
 - 5. Remove control panels, equipment sheds, and concrete bases and posts for panels and sheds.
- C. Where new lighting and receptacles are installed, old lighting, receptacles, switches, wiring, and conduits shall be removed.
- D. Raceways shall be replaced with new for all installations.
- E. The junction box shall have a NEMA rating in accordance with the area in which it is located and shall be sized as required.
- F. Materials and equipment not indicated to be removed and returned to the OWNER shall, upon removal, become the CONTRACTOR's property and shall be disposed of off-site.
- G. Material and equipment indicated to be relocated or reused shall be removed and relocated, and reinstalled with care to prevent damage thereto.
- H. Materials indicated to be returned to the OWNER shall be placed in boxes with the contents clearly marked and be stored at a location determined by the ENGINEER.
- I. Where MCCs or panelboards are indicated to have circuits removed and reconnected, the MCC shall have a new engraved phenolic nameplate worded as indicated, and the panelboard schedule shall be modified to indicate the revised circuits. Pencil or Pen marker markings directly on the MCC or panelboard breaker are not permitted. Similarly, associated wire and cable labeling shall be updated or provided new as required.

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

1.11 CONSTRUCTION SEQUENCING

- A. Continuance of facility operation during demolition and the installation process is critical at this facility. Therefore, the CONTRACTOR shall carefully examine all work to be done in, on, or adjacent to existing equipment. Work shall be scheduled, subject to the OWNER's approval under the submitted 'Outage and Work Plan', to minimize required process or equipment shutdown time.
- B. All switching, safety tagging, etc., required for process or equipment shutdown or to isolate existing equipment shall be performed by the CONTRACTOR. In no case shall the CONTRACTOR begin any work in, on, or adjacent to existing equipment without written authorization by the CBJ supervisor and the ENGINEER.
- C. The CONTRACTOR shall make all modifications or alterations to existing electrical facilities required to successfully install and integrate the new electrical equipment as indicated on the electrical drawing. Modifications to existing equipment, panels, or cabinets shall be made in a professional manner with all coatings repaired to match existing. The CONTRACTOR is responsible for ensuring all panels and equipment are UL-listed. The costs for modifications (including UL listing) to existing electrical facilities required for a complete and operating system shall be included in the CONTRACTOR's original Bid amount and no additional payment for this WORK will be authorized. Extreme caution shall be exercised by the CONTRACTOR in digging trenches in order not to damage existing underground utilities. Cost of repairs of damages caused during construction shall be the CONTRACTOR's responsibility without any additional compensation from the OWNER.
- D. The CONTRACTOR shall be responsible for identifying available existing circuit breakers in lighting panels for the intended use as required by the Drawings. The CONTRACTOR shall also be responsible for field-verifying the available space in switchboards to integrate new power circuit breakers. Costs for this WORK shall be included in the CONTRACTOR's original Bid amount.
- E. The CONTRACTOR shall visit the Site before submitting a Bid to better acquaint themselves with the WORK of this Contract. Lack of knowledge will not be accepted as a reason for granting extra compensation to perform the WORK.
- F. Installation of New Equipment:
 - 1. The CONTRACTOR shall install and terminate the new switchboards, panelboards, motor control centers, motor starters, control panels, raceways, cables, and instruments in accordance with the agreed schedule. The CONTRACTOR shall provide a list, daily, of the points that are ready for service as they are connected, calibrated, and tested. The CONTRACTOR shall only connect to equipment in a safe and code compliant manner.
- G. Construction Sequence:
 - 1. The overall construction sequence in SECTION 01 11 00 – SUMMARY OF WORK shall be reviewed thoroughly, and the overall schedule and requirements adhered to. This proposed sequence is specific to electrical/controls demolition and new work construction. The final sequence, developed by the CONTRACTOR, shall be written into a 'Electrical Work and Outage Plan' as required by this specification.
 - 2. Temporary Station power:

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- a. The existing standby generator can be utilized by the CONTRACTOR to support the station power during temporary outages for no more than three (3), eight (8) hour periods during construction. The OWNER can authorize additional use of the generator by specific request from the CONTRACTOR.
- b. The CONTRACTOR shall provide a portable standby generator unit of sufficient size to support two lift pumps running simultaneously. The unit shall be available and mobilized to the project site within 4 hours of an outage that cannot be supported by the existing standby generator or temporary utility connection.
3. Allowable down time requirements: The CONTRACTOR shall minimize the amount of time a facility is out of service as required by SECTION 01 11 00 – SUMMARY OF WORK. The CONTRACTOR shall provide the ENGINEER with an estimate of the amount of time the facility will be out of service with the required ‘Outage and Work Plan’.
4. The ENGINEER will coordinate with the CONTRACTOR to load and commission the PLC software after the CONTRACTOR makes the wiring modifications.
5. The OWNER shall take beneficial occupancy of each facility as the WORK is signed off.
 - a. Warranty: The warranty shall start from the date of final acceptance of the completed project, and shall extend for 2 years.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Equipment and materials shall be new, shall be listed by UL, and shall bear the UL label where UL requirements apply. Equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the WORK shall be products of the same manufacturer. Equipment and materials shall be of industrial grade standard of construction.
- B. Where a NEMA enclosure type is indicated in a non-hazardous location, the CONTRACTOR shall utilize that type of enclosure, despite the fact that certain modifications, such as cutouts for control devices, may negate the NEMA rating.
- C. On devices indicated to display dates, the year shall be displayed as 4 digits.

2.2 MOUNTING HARDWARE

- A. Miscellaneous Hardware:
 1. Nuts, bolts, and washers shall be stainless steel.
 2. Threaded rods for trapeze supports shall be continuous-threaded, galvanized steel, 3/8-inch diameter minimum.
 3. Strut for mounting of raceways and equipment shall 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 shall be utilized to prevent such corrosion. Strut shall be as manufactured by **Unistrut, B-Line**, or equal.

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

4. Anchors for attaching equipment to concrete walls, floors and ceilings shall 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 shall not be permitted.

2.3 ELECTRICAL IDENTIFICATION

- A. Nameplates: Nameplates shall be fabricated from black-letter, white-face laminated plastic engraving stock, **Formica type ES-1**, or equal. Each shall be fastened securely, using fasteners of brass, cadmium-plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style, with no characters smaller than 1/8-inch in height.
- B. Conductor and Equipment Identification: Conductor and equipment identification devices shall be heat-shrink plastic tubing with machine printing. Lettering shall read from left to right and shall face toward the front of the panel.

PART 3 -- EXECUTION

3.1 GENERAL

- A. Incidentals: The CONTRACTOR shall 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 shall 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, shall be followed as closely as possible.
 1. Where raceway development drawings are not shown on the plans, or "home runs," are shown, the CONTRACTOR shall route the raceways in accordance with the indicated installation requirements. Routings shall be exposed and routed parallel and perpendicular to building walls, ceilings, and floors.
 2. Conduit and equipment shall 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 shall be located within finished rooms as indicated. Where the Drawings do not indicate exact locations, the ENGINEER shall determine such locations. If equipment is installed without instruction and must be moved, it shall be moved without additional cost to the OWNER. Lighting fixture locations shall be adjusted slightly to avoid obstructions and to minimize shadows.
 3. Wherever raceways and wiring for lighting and receptacles are not indicated, it shall 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 shall be #12 AWG minimum, and conduits shall be 3/4-inch minimum. Where circuits are combined in the same raceway, the

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

CONTRACTOR shall derate conductor ampacities in accordance with NEC requirements.

4. Complete raceway systems are not shown on the plans, Contractor shall submit a raceway plan for approval. Intent is to minimize number of raceway systems.
- C. City and Borough of Juneau NEC Local Amendments: The CONTRACTOR shall comply with all requirements of the NEC local amendments.
 1. The CONTRACTOR shall pay particular attention to the additional grounding requirements. In general, grounding conductors are not specifically called out on the drawings but are required for every raceway.
- D. Workmanship: Materials and equipment shall be installed in strict accordance with printed recommendations of the manufacturer. Installation shall be accomplished by workers skilled in the work. Installation shall be coordinated in the field with other trades to avoid interferences.
- E. Protection of Equipment and Materials: The CONTRACTOR shall fully protect materials and equipment against damage from any cause. Materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts shall be kept clean and dry. The CONTRACTOR shall replace or refinish damaged materials or equipment, including faceplates of panels and switchboard sections, as part of the WORK.
- F. Incoming utility power equipment shall be provided in conformance with the utility's requirements. The CONTRACTOR shall coordinate new metering and Current Transformer equipment with the utility's requirements.
- G. The CONTRACTOR shall provide power wiring in raceways for the motor starters in accordance with Section 26 24 19 – Low Voltage Motor Control Center, for starters in MCC's and Section 25 14 05 – Local Control Stations and Miscellaneous Electrical Devices, for starters not in MCC's.

3.2 CORE DRILLING

- A. The CONTRACTOR shall perform core drilling required for installation of raceways through concrete walls and floors. Locations of floor penetrations, as may be required, shall 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 shall be repaired as part of the WORK.
- B. All penetrations required to extend raceways through concrete walls, roofs, and floors or masonry walls shall be core drilled. New stub-up locations require houskeeping curbs; see paragraph 3.3 B. below.
- C. It is the intent to utilize existing floor penetrations to the greatest extent possible. New core drilled holes shall be minimized. The CONTRACTOR shall coordinate field conditions with equipment shop drawings.

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3.3 CONCRETE HOUSEKEEPING PADS

- A. Concrete housekeeping pads shall be provided for indoor floor standing electrical equipment. Housekeeping pads for equipment, including future units, shall be 3-1/2 inches above surrounding finished floor or grade, and 2 inches larger in both dimensions than the equipment, unless otherwise indicated.
- B. Concrete housekeeping curbs shall be provided for all conduit stub-ups in indoor locations that are not concealed by equipment enclosures. Such curbing shall be 3-1/2 inches above finished floor or grade.

3.4 EQUIPMENT ANCHORING

- A. Floor supported, wall-, or ceiling-hung equipment and conductors shall 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, shall be provided with fabricated steel support pedestals. If the supported equipment is a panel or cabinet enclosed within removable side plates, it shall match supported equipment in physical appearance and dimensions. Transformers hung from 4-inch stud walls and weighing more than 300 pounds shall 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. Such recommendations shall be submitted as Shop Drawings. Where manufacturer's instructions indicate the need for engineered anchorage design, such design and installation shall be provided by the CONTRACTOR as part of the work.
- C. Panels, raceways, and other equipment shall be anchored and supported for Seismic requirements of the structural specifications and CBJ requirements.

3.5 EQUIPMENT IDENTIFICATION

- A. General: Equipment and devices shall be identified as follows:
 - 1. Nameplates shall be provided for all panelboards, control and instrumentation panels, starters, switches, and pushbutton stations. In addition to nameplates, control devices shall be equipped with standard collar-type legend plates.
 - 2. Control devices within enclosures shall be identified as indicated. Identification shall be similar to the subparagraph above.
 - 3. Equipment names and tag numbers, where indicated on the Drawings, shall be utilized on all nameplates.
 - 4. The CONTRACTOR shall furnish typewritten circuit directories for panelboards; circuit directory shall accurately reflect the equipment connected to each circuit.
 - 5. Generator receptacles shall be identified with the incoming service voltage with 1" lettering.
 - 6. Generator transfer switches shall be labeled "Main" and "Generator" with 1/2" lettering.

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

3.6 CLEANING

- A. Before final acceptance, the electrical WORK shall be thoroughly cleaned. Exposed parts shall be thoroughly clean of cement, plaster, and other materials. Oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped and all cracks and corners cleaned out. Touch-up paint shall be applied to scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum-cleaned.
- B. CONTRACTOR shall group, coil, and tie wrap all spare cables at the bottom of the Local Control Panels. The wires shall be grouped according to the device, control panel, or MCC section they originate from. Cable groups shall be tagged according to their point of origin.
- C. All debris shall be removed from the void below the panels.

3.7 CONTROL PANEL WIRING

- A. The CONTRACTOR shall ensure all panels are UL-listed upon completion of the WORK.
- B. See Division 40 specifications for additional requirements.

END OF SECTION

SECTION 26 05 00 – ELECTRICAL WORK, GENERAL

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SECTION 26 05 19 – WIRE AND CABLES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide wires and cable, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit Shop Drawings in accordance with MASS Section 10.05 Article 5.6, and 26 05 00 – Electrical Work, General.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Conductors, include grounding conductors, shall be copper. Aluminum conductor wire and cable will not be permitted. Insulation shall bear the label of Underwriters' Laboratories, Inc. (UL), the manufacturer's trademark, and identify the type, voltage, and conductor size. All conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment, such as motors and controllers, shall conform to the requirements of Article 310 of the National Electrical Code, latest adopted edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400, and fixture wires shall conform to Article 402. Wiring shall have wire markers at each end.

2.2 LOW VOLTAGE WIRE AND CABLE

- A. Power and Lighting Wire
 1. Power and lighting wire shall be No. 12 copper AWG minimum size, UON.
 2. Wire rated for 600 volts in duct or conduit for all power shall be
 - a. In above grade interior locations: Class B Type THWN-2
 - b. In underground and below grade installations XHHW-2
 - c. Direct burial shall use XLPE outer jacketed cable.
 3. Wiring for 600 volt class power and lighting shall be as manufactured by **General Cable**, **Okonite**, or **Rome Cable**.
- B. Control Wire
 1. Control wire in duct or conduit shall be the same type as power and lighting wire indicated above.
 2. Control wiring shall be No.14 19-strand copper AWG.
- C. Instrumentation Cable
 1. Instrumentation cable shall be rated at 600 volts.

SECTION 26 05 19 – WIRE AND CABLES

2. Individual conductors shall be No. 18 AWG stranded, tinned copper. Insulation shall be color-coded polyethylene: black-red for two-conductor cable, and black-red-white for three-conductor cable.
 3. Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a No. 18 AWG stranded, tinned copper drain wire, and a PVC outer jacket with a thickness of 0.048-inches.
 4. Single pair, No. 18 AWG, twisted, shielded cable shall be **Belden Part No. 9341**, or equal.
 5. Single triad, No. 16 AWG, twisted, shielded cable shall be **Belden Part No. 1119A**, or equal.
- D. Tray Cable - Tray cable is not to be used.
- E. Cat 6A Cable: Cat 6A cable shall be 4-pair 23-gauge twisted pair rated to TIA/EIA 568-B Cat. SE and UL-listed. The CONTRACTOR shall install RJ-45 connectors as required.
- F. Radio Cable: Feedline cable for radios shall be a 50 ohm low loss 5/8" Helix cable (less than 1.9 db per 100 feet) type suited for 900 MHz and rated for outdoor use with foam core. Provide type N connectors on each end of cable and provide a TNC to type N connector converter for each radio end. Cable shall be **Andrew LDF4.50A**, or equal.
1. Coaxial radio jumper cable inside the SCADA panel shall be **Times Microwave LMR-240**, or equal.
- G. Pump Power Cable: Pumps shall be wired with multi-conductor cable as required by the Drawings. The cable shall be Type W Portable Power Cable rated at 600V and 70C temperature with (2) #14 control cables. The insulation shall be EPR, and conduction shall be rope-lay-stranded copper per UL-62. The cabling shall be round with round or flat fillers as needed, with an extra-hard usage, oil resistant, thermoset, CPE jacket, per UL-1581. Cable shall be **Flygt SubCab**, or equal.
- H. VFD motor branch cable: Motors circuits operated under VFD control shall be run with shielded cable. Cable shall be **Belden 295xx** (where xx= wire gauge) or VFD Manufacturer recommended equal. Twisted shielded THHN is not permitted.

2.3 CABLE TERMINATIONS

- A. Compression connectors shall be **Burndy "Hi Lug", Thomas & Betts "Sta-Kon,"** or equal. Threaded connectors shall be split bolt type of high strength copper alloy. Pressure type, twist-on connectors will not be acceptable.
- B. Pre-insulated fork tongue lugs shall be **Thomas & Betts, Burndy**, or equal.
- C. General purpose insulating tape shall be **Scotch No. 33, Plymouth "Slip-knot,"** or equal. High temperature tape shall be polyvinyl as manufactured by **Plymouth, 3M**, or equal.
- D. Labels for coding 600-volt wiring shall be heat-shrink plastic tubing type with machine print. Lettering shall read from left to right, and face the front of the panel. Field wires terminating at a Control Panel shall be labeled with the wire number shown on the LCP Panel wiring diagrams. The CONTRACTOR shall mark all as-built drawings with wire labels.

SECTION 26 05 19 – WIRE AND CABLES

- E. See Section 25 14 05 – Local Control Stations and Miscellaneous Electrical Devices, paragraph 2.4, for a list of pump types.

PART 3 – EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall provide and terminate all power, control, and instrumentation conductors, except where indicated.

3.2 INSTALLATION

- A. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
- B. Conductors for branch circuits as defined in Article 100 of the NEC, shall be sized to prevent a voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
- C. Conductors shall not be pulled into raceway until raceway has been cleared of moisture and debris.
- D. Pulling tensions on raceway cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL-approved.
- E. The following wiring shall be run in separate raceways:
 - 1. 24 VDC discrete signal and instrument power supply.
 - 2. 4-20 mA analog signal.
 - 3. All AC circuits.
- F. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.
- G. Wet Well Conduit Seals: Conduit entering wet wells shall be sealed with duct seal at the end of the conduit where the conduit enters the wet well. Provide cloth rag backing and 1” of duct seal so duct seal can be removed in the future.

3.3 SPLICES AND TERMINATIONS

- A. General
 - 1. Wire taps and splices are not to be used unless the CONTRACTOR can convince the ENGINEER that they are essential, and the ENGINEER gives written permission.
 - 2. There shall be no cable splices in underground manholes or pull boxes.

SECTION 26 05 19 – WIRE AND CABLES

3. Stranded conductors shall be terminated directly on equipment box lugs, making sure that all conductor strands are confined within the lug. Use forked-tongue lugs where equipment box lugs have not been provided.
 4. Excess control and instrumentation wire shall be properly taped and terminated as spares.
- B. Control Wire and Cable
1. Control conductors shall be spliced or terminated only on terminal strips in panels or vendor-furnished equipment.
 2. In terminal cabinets, junction boxes, motor control centers, and control panels, control wire and spare wire shall be terminated to terminal strips.
- C. Instrumentation Wire and Cable
1. Shielded instrumentation cables shall be grounded at one end only, the receiving end (i.e., in the SCADA panel) on a 4-20 mA system.
- D. Power Wire and Cable
1. No 120/208-volt, 120/240-volt, and 480/277-volt branch circuit conductors may be spliced unless the CONTRACTOR can convince the ENGINEER that they are essential, and the ENGINEER gives written permission.
 2. Shielded power cable shall be terminated with pre-assembled stress cones in a manner approved by the cable and terminal manufacturer. The CONTRACTOR shall submit the proposed termination procedure as a Shop Drawing.

3.4 CABLE IDENTIFICATION

- A. General: Wires and cables shall be identified for proper control of circuits and equipment and to reduce maintenance effort.
- B. Identification Numbers: The CONTRACTOR shall assign to each control and instrumentation wire and cable a unique identification number. Numbers shall be assigned to all conductors having common terminals and shall be shown on "as built" drawings. Identification numbers shall appear within 3 inches of conductor terminals. "Control Conductor" shall be defined as any conductor used for alarm, annunciator, or signal purposes.
1. Multiconductor cable:
 - a. Assign a number that shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath freestanding equipment.
 - b. Cable number shall form a part of the individual wire number.
 - c. Individual control conductors and instrumentation cable shall be identified at pull points as described above.
 - d. The instrumentation cable numbers shall incorporate the loop numbers assigned in the Contract Documents.
 2. All 120/208-volt system feeder cables and branch circuit conductors shall be color-coded as follows:
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 3. The 120/240-volt system conductors shall be color-coded as follows:

SECTION 26 05 19 – WIRE AND CABLES

- a. Line 1 - Black
 - b. Line 2 - Red
 - c. Neutral - White
4. The 480/277-volt system conductors shall be color-coded as follows:
- a. Phase A - Brown
 - b. Phase B - Orange
 - c. Phase C - Yellow
 - d. Neutral - Gray
5. Color-coding tape shall be used where colored insulation is not available.
- a. Branch circuit switch shall be Yellow.
 - b. Insulated ground wire shall be Green.
 - c. Neutral shall be Gray.
6. Color coding and phasing shall be consistent throughout the Site, bus bars at panelboards, switchboards, and motor control centers shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs.
7. General purpose AC control cables shall be Red.
8. General purpose DC control cables shall be Blue.
9. Spare cable shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.
10. Terminal strips shall be identified by computer-printable, cloth, self-sticking marker strips attached under the terminal strip.

3.5 TESTING

- A. Cable Assembly and Testing: Cable assembly and testing shall comply with applicable requirements of ICEA Publication No. S-68-516 - Ethylene-Propylene-Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy. Factory test results shall be submitted in accordance with Section 013300 – Contractor Submittals, prior to shipment of cable. The following field tests shall be the minimum requirements:
1. Power cable rated at 600 volts shall be tested for insulation resistance between phases and from each phase to a ground using a megohmmeter rated 1000 volts.
 2. Field testing shall be done after cables are installed in the raceways.
 3. Field tests shall be performed by a certified test organization acceptable to the cable manufacturer. Test results shall be submitted to the ENGINEER for review and acceptance.
 4. Cables failing the tests shall be replaced with a new cable or be repaired. Repair methods shall be as recommended by the cable manufacturer and shall be performed by persons certified by the industry.
- B. Continuity Test: Control and instrumentation cables shall be tested for continuity, polarity, undesirable ground, and origination. Such tests shall be performed after installation and prior to placing all wires and cables in service.

END OF SECTION

SECTION 26 05 19 – WIRE AND CABLES

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SECTION 26 05 26 – GROUNDING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide the electrical grounding system, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 26 05 00 – Electrical Work, General apply to this Section.
- C. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts and manufacturer's services.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Division 01 and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings: Manufacturer's product information for connections, clamps, and grounding system components, showing compliance with the requirements of this Section.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Components of the grounding electrode system shall be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding Equipment, and shall conform to the applicable requirements of National Electrical Code Article 250 and local codes.

2.2 GROUNDING SYSTEM

- A. Grounding loop conductors shall be bare annealed copper conductors suitable for direct burial. Conductors shall be No. 4 for 100A services, or No. 3/0, unless indicated otherwise.
- B. Ground Rods
 - 1. Unless indicated otherwise, the ground rod shall be a minimum of 3/4-inch in diameter, 10 feet long, and have a uniform covering of electrolytic copper metallicity bonded to a rigid steel core. The copper to steel bond shall be corrosion resistant.
 - 2. Conform to ANSI/UL 467.
 - 3. Sectional type joined by threaded copper alloy couplings.
- C. Buried cable-to-cable and cable-to-ground rod connections shall be made using exothermic welds by **Cadweld, Enrico Products**, or equal.

SECTION 26 05 26 – GROUNDING

- D. Exposed grounding connectors shall be of the compression type (connector to cable), made of high copper alloy, and be manufactured specifically for the particular grounding application. The connectors shall be **Burndy, O.Z. Gedney**, or equal.
- E. Grounding clamps shall be used to bond each separately derived system to the grounding electrode conductors.
- F. Equipment Grounding Circuit Conductors
 - 1. These conductors shall be the same type and insulation as the load circuit conductors. The minimum size shall be as outlined in Table 250.122 of the National Electrical Code, unless indicated otherwise.
 - 2. Metallic conduit systems shall have equipment grounding wires as well as being equipment grounding conductors themselves.
- G. Ground clamps in concrete shall be rated for use with rebar and embedded in concrete.
- H. Manufacturers of grounding materials shall be **Copperweld, Blackburn, Burndy**, or equal.

PART 3 -- EXECUTION

3.1 GROUNDING

- A. Provide a separate equipment grounding conductor, securely grounded in each raceway independent of raceway material.
- B. Provide a separate grounding conductor for each motor and connect at motor box. Do not use bolts securing motor box to frame or cover for grounding connectors.
- C. Size in accordance with the NEC-Article 250 and local amendments.
- D. Route conductors inside raceway.
- E. Provide a grounding type bushing for secondary feeder conduits which originate from the secondary section of each MCC section, switchboard, or panelboard.
- F. Individually bond these raceways to the ground bus in the secondary section.
- G. Provide a green insulated wire as grounding jumper from the ground screw to a box grounding screw and, for grounding type devices, to equipment grounding conductor.
- H. Provide a separate grounding conductor in each individual raceway for parallel feeders.
- I. Interconnect the secondary switchgear neutral bus to the ground bus in the secondary switchgear compartment only at service entrance point or after a transformer.
- J. Bond cold water pipe systems and metallic building structure per NEC. Bond ALL water pipe penetrations.

SECTION 26 05 26 – GROUNDING

- K. Measure ground impedance in accordance with IEEE STD 81 after installation but before connecting the electrode to the remaining grounding system.

- L. Low Voltage Grounded System (600-volt or less): A low voltage grounded system is a system where the local power supply is a transformer with the transformer secondary grounded.
 - 1. Grounding system connections for a premises wired system supplied by a grounded AC service shall have a grounding electrode connector connected to the grounded service conductor at each service, in accordance with the NEC.
 - 2. The grounded circuit conductor shall not be used for grounding non-current carrying parts of equipment, raceways, and other enclosures except where specifically listed and permitted by the NEC.

- M. Embedded Ground Connections
 - 1. Underground and grounding connections embedded in concrete shall be UL listed compression type ground grid connectors.
 - 2. The connection shall be made in accordance with the manufacturer's instructions.
 - 3. The CONTRACTOR shall not conceal or cover any ground connections until the ENGINEER or authorized representative has established that every grounding connection conforms to the Contract Documents and has given the CONTRACTOR written confirmation.

- N. Ground Rods
 - 1. Locations shall be as determined in the field.
 - 2. Rods forming an individual ground array shall be equal in length.
 - 3. Rod spacing shall be a minimum of the rod length.

- O. Shield Grounding
 - 1. Shielded instrumentation cable shall have its shield grounded at one end only unless Shop Drawings indicate the shield will be grounded at both ends.
 - 2. The grounding point shall be at the control panel or otherwise at the receiving end of the signal carried by the cable.
 - 3. Termination of shield drain wire shall be on its own terminal screw.
 - 4. Terminal screws shall be jumpered together using manufactured terminal block jumpers.
 - 5. Connection to the ground bus shall be via a green No. 12 conductor to the main ground bus for the panel.

END OF SECTION

SECTION 26 05 26 – GROUNDING

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SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide electrical raceway systems, complete and in place, in accordance with the Contract Documents.
- B. Local amendments to NEC require:
 - 1. The equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following:
 - a. A copper, aluminum, or copper-clad aluminum conductor.
 - b. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire or a bus bar of any shape.

1.2 DEFINITIONS

- A. Raceway System – conduits, wireways, fittings, junction and pull boxes, supports, and labels, complete and ready for conductors.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Conduits, wireways, fittings, supports, labels, junction and pull boxes, and other indicated enclosures which are dedicated to the raceway system, shall comply with the requirements of this Section.

2.2 CONDUIT

- A. Galvanized Rigid Steel Conduit (GRC)
 - 1. Rigid steel conduit shall be mild steel, hot-dip galvanized inside and out.
 - 2. Rigid steel conduit shall be manufactured in accordance with ANSI C80.1 - Rigid Steel Conduit, Zinc Coated, and UL-6.
 - 3. Manufacturers, or Equal
 - a. **LTV Steel;**
 - b. **Triangle;**
 - c. **Wheatland Tube.**
 - 4. GRC shall be used in all locations except outdoor locations, below grade or NEMA-4X locations.
- B. PVC-Coated Galvanized Rigid Steel Conduit (PVC-coated GRC)
 - 1. The conduit, prior to PVC coating, shall meet the requirements for GRC conduit above.
 - 2. A PVC coating shall be bonded to the outer surface of the galvanized conduit. The bond between the coating and the conduit surface shall be greater than the tensile strength of the coating.
 - 3. PVC coating thickness shall be not less than 40 mils.

SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

4. PVC-coated GRC shall be manufactured in accordance with the following standards:
 - a. UL-6
 - b. ANSI C80.1
 - c. NEMA RN1 - PVC Externally Coated Galvanized Rigid Steel Conduit, Intermediate Metal Conduit, and where shown on the plans
 5. Manufacturers, or Equal
 - a. **Robroy**;
 - b. **Ocal**.
 6. PVC-coated GRC shall be used in all direct-bury installations, outdoor locations, below-ground facilities, NEMA 4X designated areas, and where shown on the drawings.
- C. Liquidtight Flexible Conduit (LFMC)
1. Liquidtight flexible conduit (LFMC) shall be constructed of a flexible galvanized metal core with a sunlight-resistant thermoplastic outer jacket.
 2. LFMC shall be manufactured in accordance with UL-360 - Steel Conduits, Liquid-Tight Flexible.
 3. Manufacturers, or Equal
 - a. **Anaconda, "Sealtite"**;
 - b. **Electriflex, "Liquatite"**.
- D. Electrical Metallic Tubing (EMT) or Intermediate conduit (IMC) will not be accepted.

2.3 FITTINGS AND BOXES

- A. General:
1. Cast and malleable iron fittings for use with metallic conduit shall be the threaded type with 5 full threads.
 2. Fittings and boxes shall have neoprene gaskets and non-magnetic stainless steel screws. All covers shall be attached by means of holes tapped into the body of the fitting. Covers
 3. Non-explosion-proof boxes larger than standard cast or malleable types shall be 304 stainless steel, NEMA 4X.
 4. Boxes larger than standard cast or malleable types shall be 304 stainless steel, NEMA 4X.
 5. In outdoor areas, raceways shall be terminated in raintight hubs as manufactured by **Myers, O.Z. Gedney**, or equal. In other than outdoor areas, sealed locknuts and bushings shall be used.
 6. Fittings and boxes in hazardous locations shall be suitable for the Class and Division indicated or required by code.
- B. Cast Aluminum Fittings and Boxes
1. Cast aluminum boxes and fittings shall have less than 0.40 percent copper content.
 2. Manufacturers, or Equal
 - a. **O.Z. Gedney**;
 - b. **Appleton**;
 - c. **Crouse-Hinds**.
- C. Malleable Iron Fittings and Boxes

SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

1. Fittings and boxes for use with galvanized steel conduit shall be of malleable iron or gray-iron alloy with zinc plating.
 2. Manufacturers, or Equal
 - a. **O.Z. Gedney;**
 - b. **Crouse-Hinds;**
 - c. **Appleton.**
- D. PVC-Coated Fittings and Boxes
1. Fittings and boxes for use with PVC-coated GRC shall be PVC-coated and shall be products of the same manufacturer as the conduit.
 2. Fittings used for LFMC and PVC-coated systems are to be PVC-coated.
- E. Stainless Steel Boxes
1. Stainless steel boxes shall be used with PVC-coated GRC raceway systems, in NEMA 4X designated areas, and where indicated on the Drawings.
 2. Stainless steel boxes shall be NEMA 4X, Type 304.
 3. Stainless steel shall be a minimum 14-gauge thickness, with a brushed finish.
 4. Doors shall have full-length stainless steel piano hinges. Non-hinged boxes are not acceptable.
 5. Manufacturers, or Equal
 - a. **Hoffman;**
 - b. **Rohn;**
 - c. **Hammond.**

2.4 WIREWAYS

- A. All wireways shall be painted ANSI 61 gray, galvanized 14-gauge steel with screw covers and a steel divider to separate the discrete signals from the analog signals. Wireways shall be **Hoffman**, or equal.
- B. Wireway shall be NEMA 12 and used only in above ground indoor locations.
- C. Wireway systems not shown on the plans shall be submitted for approval.

2.5 CABLE TRAYS

- A. Cable trays are not to be used.

2.6 IDENTIFICATION TAPE

- A. Continuous lengths of warning tapes shall be installed 12 inches above and parallel to all underground conduits. Tape shall be 6-inch-wide polyethylene film imprinted, "CAUTION – ELECTRIC UTILITIES BELOW." Tape shall be as manufactured by **Brady**, or equal.

SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

2.7 EXPLOSION-PROOF BOXES

- A. Explosion-proof boxes shall be used to house control stations, switches, any arc producing device, and terminal for splicing in hazardous locations. The boxes shall be made from copper-free aluminum with stainless steel hardware, have a hinged cover, and use O-ring gaskets for watertight integrity. The boxes shall be factory painted with epoxy gray paint. Boxes 12" x 12" and larger shall have (1) 2" hole and (2) 1.5" holes, and (2) 1" holes drilled, tapped, and plugged on the bottom of the box. The boxes shall be **Appleton Electric**, **AJBEW**, or equal.

2.8 EXPLOSION-PROOF CONDUIT FITTINGS AND UNIONS

- A. Explosion-proof conduit fittings and unions shall be made from zinc electroplated malleable iron. Fittings shall include gasketed water-tight connections, be UL-listed for use in Class 1 Division 1 areas. Fittings shall be **Appleton Electric**, or equal.

PART 3 – EXECUTION

3.1 GENERAL

- A. All wiring shall be run in raceway unless indicated otherwise.
- B. Raceways shall be installed between equipment as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be accomplished with tools designed for this purpose. Field bends are required on conduits up to 2". Factory elbows may be utilized on raceways over 2". All fittings and connections shall be made tight.
- C. Separate raceway systems shall be provided for:
 - 1. Analog signals
 - 2. 24 VDC discrete signals and instrument power supply conductors
 - 3. 120 VAC and higher wiring

When non-loop powered instruments have only one raceway port, the CONTRACTOR may run both the analog and 24 VDC wiring in a short length of ½" LFMC to a splitter box where the wiring must then be separated into the required raceway system. The length of LFMC must be kept to the absolute minimum and must not exceed 3 feet unless written approval has been given by the ENGINEER.

- D. Where raceway routings are indicated on plan views, follow those routings to the extent possible. See SECTION 26 05 00 – ELECTRICAL WORK, GENERAL Article 3.1 Paragraph B. for additional installation requirements.
- E. Routings shall be adjusted to avoid obstructions. Coordinate between trades prior to installation of raceways. Lack of such coordination shall not be justification for extra compensation, and removal and re-installation to resolve conflicts shall be by the CONTRACTOR as part of the WORK.

SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

- F. Support rod attachment for ceiling-hung trapeze installations shall meet the seismic requirements.
- G. Exposed raceways shall be installed parallel or perpendicular to structural beams.
- H. Install expansion fittings with bonding jumpers wherever raceways cross building expansion joints.
- I. Exposed raceways shall be installed at least 1/2-inch from walls or ceilings except that at locations above finished grade where damp conditions do not prevail, exposed raceways shall be installed 1/4-inch minimum from the face of walls or ceilings by the use of clamp backs or struts.
- J. In underground facilities or NEMA 4X areas, all raceway penetrations in panels shall be bottom entry.
- K. Wherever contact with concrete or dissimilar metals can produce galvanic corrosion of equipment, suitable insulating means shall be provided to prevent such corrosion.
- L. To facilitate future expansion, boxes and fittings are to be installed when indicated on the drawings. Unused hubs are to be plugged with proprietary devices. Raceways that include future expansion provision are to be sized to accommodate any such specified wiring without exceeding the requirements of this specification.
- M. The maximum allowable conduit fill for instrumentation and control wiring is given by the following table:

Conduit Diameter	No. of 14-Gauge Wires	No. of 18-Gauge TWS
3/4"	8	2
1"	16	4
1-1/4"	32	7
1-1/2"	48	10
2"	72	17

Note: No instrumentation or control wiring conduit is to be larger than 2 inches in diameter.

3.2 RACEWAYS

- A. Exposed raceway systems shall be rigid galvanized steel except as follows, unless indicated otherwise:
 - 1. In outdoor areas, all underground vaults, and NEMA 4X areas, PVC-coated GRC shall be utilized.
- B. Raceways concealed, buried, or encased in concrete, shall be PVC-coated GRC. Where conduit emerges from concrete encasement, a PVC-coated GRC elbow shall be utilized for

SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

transition from the concrete. Conduit shall emerge from the concrete perpendicular to the surface whenever possible.

- C. Exposed conduit shall be 3/4-inch minimum trade size. Supports shall be installed at distances required by the NEC. Conduit support design shall be by the CONTRACTOR.
- D. Conduit shall not be encased in the bottom floor slab below grade.
- E. Concrete cover for conduit and fittings shall not be less than 1-1/2 inches for concrete exposed to earth or weather, or less than 3/4-inch for concrete not exposed to weather or in contact with the ground.
- F. Raceways passing through a slab, wall, or beam shall not impair significantly the strength of the construction.
- G. Raceways embedded within a slab, wall, or beam (other than those merely passing through) shall satisfy the following:
 - 1. Conduits with their fittings embedded within a column shall not displace more than 4 percent of the gross area of cross section.
 - 2. Conduits shall not be larger in outside dimension than one third the overall thickness of slab, wall, or beam in which embedded.
 - 3. Raceways shall not be spaced closer than 3 outside diameters on centers.
- H. Raceways shall be placed so that cutting, bending, or displacing reinforcement from its proper location will not be required.
- I. Threads shall be coated with a conductive lubricant before assembly.
- J. Joints shall be tight, thoroughly grounded, secure, and free of obstructions in the pipe. Conduit shall be adequately reamed to prevent damage to the wires and cables inside. Strap wrenches and vises shall be used to install conduit to prevent wrench marks on conduit. Conduit with wrench marks shall be replaced.
- K. Wherever raceways enter substructures below grade, the raceways shall be sloped to drain water away from the structure. Extreme care shall be taken to avoid pockets or depressions in raceways.
- L. Connections to lay-in type grid lighting fixtures shall be made using LFMC not exceeding 4-feet in length. Connections to motors and other equipment subject to vibration shall be made with LFMC not exceeding 3-feet in length. Equipment subject to vibration that is normally provided with wiring leads shall be provided with a cast junction box for the make-up of connections. The junction box is to be independently supported and not left free to hang from the equipment.
- M. Raceways passing through walls or floors shall have plastic sleeves. Core drilling shall be performed in accordance with Section 26 05 00.
- N. Provide raceway seal fittings at the following locations:
 - 1. In hazardous classified locations, in strict accordance with the NEC.

SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

- O. Conduit, fittings, and boxes required in hazardous classified areas shall be suitably rated for the area and shall be provided in strict accordance with NEC requirements.
- P. Empty raceways shall be tagged at both ends to indicate the final destination. Where it is not possible to tag the raceway, destination shall be identified by a durable marking on an adjacent surface. A pull-cord shall also be installed in each empty conduit. This shall apply to conduits in floors, panels, manholes, equipment, etc.
- Q. Where an underground raceway enters a structure through a concrete roof or a membrane waterproofed wall or floor, core-drill the entrance and provide a Link-Seal, or equal, sealing device. The sealing device shall be utilized with rigid steel conduit.
- R. Final connections to heaters, instruments, motors, limit switches, and any equipment subject to vibration shall be made with LFMC and approved fittings. Maximum length of LFMC shall be 3 feet.
- S. Connections to solenoid valves, pilot actuators, and flood sensors shall be made with LFMC and approved fittings to a cast box with screw cover (GUA type), independently and securely supported. In no case is the device to support the cast box.

3.3 CABLE TRAYS

- A. Cable trays are not to be used.

END OF SECTION

SECTION 26 05 33 – ELECTRICAL RACEWAY SYSTEMS

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SECTION 26 22 00.05 – DRY TYPE TRANSFORMERS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide dry-type transformers, complete and operable, in accordance with the Contract Documents.
- B. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.2 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be in accordance with Div. 01 and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings
 - 1. Transformers
 - a. Dimension drawings
 - b. Technical certification sheets
 - c. Drawing of conduit entry/exit locations
 - d. Transformer ratings, including:
 - 1) Voltage
 - 2) Continuous current
 - 3) Basic impulse level for equipment over 600 volts
 - 4) kVA
 - 5) Impedance
 - 6) Temperature Rise
 - e. Descriptive bulletins
 - f. Product sheets

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Transformers
 - 1. The transformers shall be dry-type, designed, manufactured, and tested in accordance with the latest applicable standards of ANSI and NEMA.
 - 2. Transformers shall be UL-listed and bear the UL label.

2.2 TRANSFORMERS

- A. Ratings
 - 1. kVA and voltage ratings shall be as indicated.

SECTION 26 22 00.05 – DRY TYPE TRANSFORMERS

2. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96 - Guide for Loading Dry Type Distribution and Power Transformers
 3. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:
 - Up to 9 kVA 40 db
 - 10 to 50 kVA 45 db
 - 51 to 150 kVA 50 db
- B. Construction
1. Insulation Systems
 - a. Transformers shall be insulated as follows:
 - 1) 2 kVA and below: 150 degrees C insulation system based upon 80 degree C rise.
 - 2) 3 to 15 kVA: 185 degrees C insulation system based upon 115 degrees C rise.
 - 3) 15 kVA and above: 220 degrees C insulation system based upon 150 degrees C rise.
 - b. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient.
 - c. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM D 635 – Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
 2. Transformer windings shall be copper.
 3. Transformers rated 15kVA and above shall have four 2-1/2 percent taps, two above and two below 480 volts.
- C. Manufacturers: Transformers shall be floor- or wall-mounted type by **General Electric, Cutler-Hammer, Square D**, or equal.

PART 3 -- EXECUTION

3.1 GENERAL

- A. All WORK of this Section shall be installed as indicated in Section 26 05 00 – Electrical Work, General.

END OF SECTION

SECTION 26 24 16.05 – PANELBOARDS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide panelboards complete and operable, in accordance with the Contract Documents.
- B. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.
- C. The CONTRACTOR shall field verify the existing installation and coordinate the installation of new panelboards and similar products with the location of existing equipment.

1.2 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be in accordance with Div. 01 and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings
 - 1. Breaker layout drawings with dimensions and nameplate designations
 - 2. Component list
 - 3. Drawings of conduit entry/exit locations
 - 4. Assembly ratings including:
 - a. Short circuit rating
 - b. Voltage
 - c. Continuous current
 - 5. Cable terminal sizes
 - 6. Descriptive bulletins
 - 7. Product sheets
 - 8. Installation information
 - 9. Seismic certification and equipment anchorage details

PART 2 -- PRODUCTS

2.1 PANELBOARDS

- A. Panelboards shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 – Safety Enclosures for Electrical Equipment and UL 67 – Safety Panelboards. Panelboards used for service equipment shall be UL labeled for such use. Lighting panelboards shall be rated for 600-volt for 3-phase, 4-wire operation as indicated. Power panelboards shall be rated for 600-volt, 3-phase, 4-wire operation.
- B. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.

SECTION 26 24 16.05 – PANELBOARDS

C. Ratings

1. Panelboards rated 208 VAC or less shall have short circuit ratings not less than 10,000 amps RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.
2. Panelboards rated 480 VAC shall have short circuit ratings not less than 25,000 amps RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.
3. Panelboards shall be labeled with a UL short circuit rating. Series ratings are not acceptable.
4. Service entrance panelboards (panels connected to transfer switches or power meters) rated 480 VAC or less shall have short-circuit rating not less than 65,000 amps RMS symmetrical, unless a reduced rating is recommended by the Protective Device Study.
5. The VFD circuit breakers shall be time-delay units, shall be UL-listed for VFD loads, and approved by the VFD manufacturer for protection of their drives.

D. Construction

1. All lighting and power distribution panels shall have copper bus bars.
2. Breakers shall be one, two, or three pole as indicated, with ampere trip ratings as required by the equipment. Breakers shall be quick-make and quick-break, inverse time trip characteristics, to trip free on overload or short circuit, and to indicate trip condition by the handle position.
3. The panels shall have hinged doors with combination catch and latch. The front panels shall be so arranged that when the plates are removed, the gutters, terminals and wiring will be exposed and accessible. The doors shall have inner doors within the plates to have only the breaker operating mechanism exposed when they are opened. Live conductors and terminals shall be concealed behind the plates.
4. All panelboards shall be rated for the intended voltage.
5. All circuit breakers shall be interchangeable and capable of being operated in any position as well as being removable from the front of the panelboard without disturbing adjacent units. No plug-in circuit breakers will be acceptable.
6. Lighting and power distribution panels which are not part of a motor control center shall be constructed in accordance with Section 26 05 00 – Electrical Work, General. Panels shall have the necessary barriers, supports, and liberal wiring gutters. Trim screws shall be stainless steel. All panelboard parts of metal other than copper, aluminum, or stainless steel shall be cadmium plated. Panelboards shall be as manufactured by **Allen-Bradley, General Electric, Square D, or Cutler-Hammer**.
7. Panelboards shall be UL listed except for special enclosures which are not available with UL listing.
8. Panelboards shall be suitable for use as service entrance as indicated or as otherwise required by the N.E.C.

PART 3 -- EXECUTION

3.1 GENERAL

- A. All WORK of this Section shall be installed as indicated in Section 26 05 00 – Electrical Work, General.

END OF SECTION

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide motor control centers (MCC's), complete and operable, in accordance with the Contract Documents.
- B. The requirements of Division 26 Specification Sections apply to the WORK of this Section.

1.2 QUALITY ASSURANCE

- A. General: All materials shall be inspected for compliance with Section 26 05 00 – Electrical Work, General, and shall be tested per Section 26 01 26 – Electrical Tests.
- B. The MCC assembly and its components shall be of the manufacturer's latest approved design. MCCs and components shall meet the UL-845 and IEC 60439-1 requirements and bare the appropriate labels.
- C. Modifications to an existing MCC shall be field evaluated to UL 845 and any other applicable standard as required by the components comprising the modified assembly. Individually listing MCC "buckets" to UL 508A is not acceptable.
- D. Factory Tests: Design test reports conducted on similar assemblies at the factory testing facilities shall be submitted.

1.3 WARRANTY

- A. The system warranty shall be no less than one year after initial startup and shall include all costs for repair, parts, travel and living expenses, and labor.

1.4 OPERATION AND MAINTENANCE

- A. The CONTRACTOR shall submit operation and maintenance procedures for each of the new MCCs for the ENGINEER's review. The data sheets shall be supplemented by written text and shall include the following:
 - 1. Operating procedures.
 - 2. Maintenance procedures.
 - 3. Manufacturers' parts list, illustrations, assemblies, and diagrams.

1.5 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be in accordance with Div. 01 and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings
 - 1. Enclosure NEMA rating and color

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

2. Horizontal and vertical bus ampacities, voltage rating and interrupting capacity. Include materials of construction
3. Ground bus size and material of construction
4. Conduit entrance provisions
5. Main incoming line entry provision (top or bottom)
6. Control unit nameplate schedule
7. All circuit breaker types, frames and settings
8. All starter NEMA sizes, auxiliary contact provisions, coil voltage
9. Relays, timers, pilot devices, control transformer VA and fuse sizes
10. Elementary schematic ladder diagrams for each compartment. Custom schematics shall be furnished. Diagrams shall include all remote devices. Submittals with drawings not meeting this requirement will not be reviewed further and will be returned to the CONTRACTOR stamped "REJECTED-RESUBMIT."
11. Short circuit rating of the complete assembly
12. Replacement parts lists and operation and maintenance procedures
13. Seismic design certification of the anchoring system in accordance with Section 26 05 00
14. Time-current curves for all protective devices
15. Motor protection system wiring and connections

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Devices of the same type shall be products of the same manufacturer.
- B. Motor control centers shall conform to the standards for NEMA Class IIS, type B diagrams and wiring. All equipment within the MCC shall be front accessible.
- C. MCC Schedule

MCC Designation	Location	Drawing
MCC – Outer Drive LS	Station Ground Level	E - 205
MCC – West Juneau LS	Station Ground Level	E - 207

The MCC shall contain all items and accessories required for a complete working system.

2.2 DESIGN, CONSTRUCTION, AND MATERIAL REQUIREMENTS

- A. Motor Control Centers (MCC)
 1. Shall be 600-volt class suitable for operation on a three-phase, 60-Hz system.
 2. The system operating voltage and number of wires shall be as indicated.
- B. Enclosure
 1. Shall be NEMA Type 12, gasketed enclosure.
 2. Compartment doors shall be interlocked with compartment circuit breakers.

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

3. The interlock shall be fitted with a maintenance override.
- C. Unless otherwise indicated, the vendor shall provide a quotation for Type 2 Arc- Resistant MCC that is designed, constructed, and tested to withstand the effects of an internal arcing fault.
1. The MCC shall be successfully tested in accordance with the requirements of IEEE C37.20.7.
 2. Doors shall be capable of withstanding the effects of an internal arcing fault as proven by successful testing per IEEE C37.20.7.
 3. Arc-resistant design shall withstand arcing durations for a minimum of 0.5 seconds (2 cycles) at rated power and frequency of equipment. The arc- resistant design shall not be based on the function of high-speed fault detectors that are sensitive to light, pressure, or heat.
 4. Arc-resistant design testing shall be performed per the IEEE C37.20.7 using the maximum short-circuit current available for the system or devices rating as the perspective current available at the incoming bus terminals of the test sample.
- D. Arc-resistant motor controllers shall have the following features:
1. Insulation of the bus extension cover-plates.
 2. Arc-containment unit door latches.
 3. Vertical wireway doors shall be provided with arc resistant latches to help keep the door latched in the event that an internal arcing fault occurs
- E. Size and Arrangement
1. Motor control centers shall be of mechanical groupings of control center units, assembled into a lineup of control center sections. Each control section shall be sized as shown on the drawings.
 2. MCCs shall be designed to not exceed the space requirements as indicated on the Contract Drawings, including spaces, spares, and future compartments. MCCs shall be subject to rejection for exceeding the lengths indicated where allotted space is critical.
 3. Equipment within the MCC may be rearranged at the discretion of the manufacturer, providing the MCC provides the spares, space, and future provisions indicated.
 4. All switches and circuit breakers used as switches shall be located so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, will not be more than 6-feet 7-inches above the floor, including the height of the concrete pad.
 5. All MCC sections shall be 20” deep.
- F. Components
1. Busses
 - a. A continuous copper ground bus shall be provided with full width of the motor control center line-up.
 - b. The main horizontal bus shall be tin-plated copper located within an isolated compartment. The bus shall be rated as indicated on the Contract Drawings minimum, but in no instance less than the main lug or main breaker frame size.
 - c. The vertical bus in each section shall consist of a single tin-plated copper conductor per phase. The vertical bus shall be completely isolated and insulated, and shall extend the full height of the section wherever possible.

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- d. All power busses shall be braced to withstand 65,000 amps, minimum.
 - e. All bus compartments shall provide complete enclosure from cable termination areas.
 - f. The lugs on the bus shall be round.
2. Wireways
 - a. A separate vertical wireway shall be provided adjacent to each vertical unit, and shall be covered by a hinged door.
 - b. Each individual unit compartment shall be provided with a side barrier to permit pulling wire in the vertical wireway without disturbing adjacent unit components.
 3. Distribution Section: The distribution section shall consist of molded case circuit breakers of the size indicated.
- G. Cabinet
1. Structural members shall be fabricated of not less than 12-gauge steel and side and top panels and doors shall be not less than 14-gauge steel.
 2. Spaces designated as "SPACE" or "EMPTY" shall include blank hinged doors and vertical bus bars.
 3. Control units inside compartments shall be clearly identified with tags or stencil markings.
 4. Each control unit including spares, spaces and blanks, lights, and devices shall be identified by an engraved nameplate. Identification shall include circuit number as indicated.
 5. Each motor control center shall be fitted with the manufacturer's nameplate which shall include the NEMA Standard electric rating and other pertinent data, including manufacturer, sales order number, date of manufacture, and place of manufacture.
 6. Fans, heat exchangers, transformers, capacitors, junction boxes, or other devices may not be mounted on the outside of the motor control center enclosure.
- H. Control Wiring:
1. All control wiring shall be brought to identified terminal blocks; every cubicle containing control wiring which extends to other cubicles shall have terminal blocks. Connection made on terminal blocks and on internal devices shall be by means of locking spade-type pre-insulated terminals.
 2. Control and secondary wiring shall be 600 V flame-retardant switchboard-type, minimum size No. 14 AWG, stranded tinned copper. Hinge wiring shall be extra-flexible stranding.
- I. Terminal Blocks
1. Terminal blocks for all external control connections shall be 600-volt, barrier type, having a minimum rating of 20 amps with marker strips identifying all internal and external wiring.
 2. Terminal blocks for current transformer secondary connections shall be of the short-circuiting type. One 4-pole block shall be used for each current transformer set.
- J. Instrument Transformers
1. Current Transformers: The quantity and ratio of current transformers shall be as indicated. Current transformers shall have thermal and mechanical ratings and insulation

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

class not less than those of the associated circuit breakers. Current transformers shall be mounted in such a way as to provide easy access for inspection and maintenance.

2. Provide test blocks and plugs for current and potential circuits for the main breaker(s).

K. Nameplates

1. Nameplates shall be provided for front and rear face of each cubicle and for major devices thereon, such as meters, instruments, control switches, and relays.
2. Nameplates shall also be provided for major internal devices such as relays, instrument and control power transformer, fuse blocks, switches, and transformers.
3. Cubicle nameplates shall be 3-layer laminated phenolic plastic, white background, engraved to show black lettering.
4. Lettering shall be upper case as follows:
 - a. 1-inch high for switchgear identification.
 - b. 7/16-inch high for compartment identification.
 - c. 1/8-inch high for component nameplate.
5. Thickness
 - a. Nameplates 1-1/2 inches tall and smaller shall be 1/16-inch thick.
 - b. Nameplates larger than 1-1/2 inches tall shall be 1/8-inch thick.
6. Edges of nameplates shall be beveled.
7. Nameplates shall be fastened to equipment with stainless steel rivets or screws.

L. Surface Preparation, Painting, and Cleanliness

1. Metal surfaces shall be smooth and free of all foreign matter such as scale, sand, blisters, weld splatter, metal chips and shavings, oil, grease, organic matter, and rust, and shall be chemically cleaned and treated in a process which provides a phosphate coating.
2. Immediately after the treatment process, the surfaces shall be sprayed with a coating each of primer and finish paint; both shall be baked. Electrostatically deposited powder coated epoxy finishes, oven baked and 1-mil minimum thickness indoor and 2 mils minimum thickness outdoor, are acceptable.
3. All surfaces shall be finish painted light gray No. 61. The manufacturer's standard practice of double-tone finish on the low voltage switchgear section is acceptable.
4. Two spray cans of air-drying paint of each color tone shall be furnished to the ENGINEER.

2.3 FULL VOLTAGE NON-REVERSING (FVNR) MOTOR STARTERS

- A. Motor starters shall be mounted in standard motor control center assemblies, arranged as indicated.
- B. Each motor starter unit shall consist of a combination magnetic contactor and short circuit protective device, mounted in a completely enclosed cubicle. Short circuit protective device shall be an instantaneous, magnetic only circuit breaker, **Cutler-Hammer Type HMCP**, or equal. All circuit breakers provided as part of a motor starter unit shall be capable of being padlocked in the open position.
- C. Three-phase overload trip units shall be furnished to suit the full load current of the equipment installed. The overload unit shall be **Allen-Bradley Model E300 solid-state overload relay**, or equal. Reset of the overload unit shall be possible with the unit door, or front panel, closed.

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Contacts and outputs on the E300 unit are to be wired as required by electrical motor control diagrams.

- D. The combination motor starters shall be drawout-type for size 5 and below. The fixed-type unit assembly shall be constructed so that it can be easily removed from its panel after disconnecting the wires to the terminal block and withdrawing from the primary bus. Removal of a unit assembly shall be possible without rear access and without disturbing any other unit in the motor control center.
- E. Each starter unit shall have its own control power transformer. It shall have a 120-volt grounded secondary. One secondary fuse and two primary fuses shall be provided. Control power transformers shall be sized to accommodate the control devices indicated. Local control devices shall be mounted independently of the cover door. All starters shall have a local green "running" lamp. Starters shall be provided with hand/off/auto selector switches, and other devices as indicated. All cubicle control wires shall be terminated at a pull apart disconnecting terminal block at the cubicle.
- F. The motor control center manufacturer shall be responsible for identifying each control wire within each motor starter unit with wrap-around permanent plastic markers. Each control wire shall be identified at both ends.
- G. Full voltage motor starter units shall be NEMA Size 1 or larger. Each combination starter shall be rated for a minimum 25,000 RMS symmetrical amperes.
- H. Motor starters shall be designed to NEMA ratings. Only starters designed to IEC ratings or with dual IEC/NEMA ratings are acceptable as soft-start bypass contactors.

2.4 REDUCED VOLTAGE SOLID STATE (RVSS) MOTOR STARTERS

- A. RVSS starter assemblies shall be UL-listed and shall consist of
 1. an incoming power circuit breaker,
 2. a power section,
 3. logic board,
 4. protective fusing, and
 5. Paralleling bypass contactor to be energized when the starter reaches full voltage.
- B. In addition, MCC installation of RVSS starters shall meet all of the applicable requirements listed in 2.3 above.
- C. RVSS starters shall include adjustments for starting torque, acceleration rate control by voltage ramps, and current limit.
- D. Output contactors shall be provided where indicated.
- E. RVSS Motor Starters are not anticipated for use on this project.

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2.5 VARIABLE FREQUENCY DRIVES (VFD)

- A. VFD installation in MCC's shall meet all the applicable requirements listed in 2.3 above and incorporate the following:
 - 1. Additional cooling required to operate the VFD on a continuous basis at its least efficient speed.
 - 2. All incoming and outgoing conductors shall be routed away from all other power and control conductors. If separation is not feasible, VFD based power and control shall be run in metallic conduit.
- B. VFD's shall be provided in accordance with SECTION 26 29 23 – VARIABLE FREQUENCY DRIVE UNITS.

2.6 MAIN AND FEEDER CIRCUIT BREAKERS (480/208-VOLT)

- A. Circuit breakers having a frame size of 150 amps or less shall be molded-case type with thermal magnetic non-interchangeable, trip-free, sealed trip units, unless indicated otherwise on the Plans.
- B. Circuit breakers with a frame size of 225 amps to 1,200 amps shall be molded case with RMS sensing electronic trip elements as indicated on the Plans.
- C. The interrupting capacity of all main, and feeder branch circuit breakers shall be a minimum of 25,000 RMS symmetrical amperes.
- D. Circuit breaker disconnect operators shall be capable of accommodating three padlocks for locking in the "open" position.
- E. Provide neutral pad or neutral bar for future 4-Wire WYE service.

2.7 TRANSFORMERS

- A. All indoor transformers shall be dry-type and shall conform to or exceed the requirements of the latest applicable IEEE, NEMA and ANSI standards.
- B. Transformers rated 15 kVA and above shall have 4 2-1/2 percent taps, 2 above and 2 below 480 volts. Transformers shall be enclosed within the MCC.
- C. Additional requirements for transformers are specified in Section 26 22 00.05 – Dry Type Transformers.

2.8 CONTROL DEVICES

- A. All control devices shall conform to the requirements of Section 25 14 05 – Local Control Stations and Miscellaneous Electrical Devices.
- B. Provide solid state type metering where indicated. Include CTs of ratios as indicated.

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

- C. The metering equipment shall be housed in a separate compartment and shall be isolated from adjacent elements by steel or appropriate insulated barriers. See SECTION 25 36 16 MONITORING TRANSDUCERS.

2.9 ETHERNET INTERFACE

A. General

- 1. The MCC shall have Cat6A Ethernet/IP cabling as shown schematically on drawings.
- 2. Each motor starter, VFD, and RVSS in the MCC shall be supplied with a means to communicate via Ethernet/IP,
- 3. Bridges and Protocol Convertors are not permitted.
- 4. All units shall be interwired and tested as a NEMA Class II MCC.

B. Ethernet/IP Cable

- 1. The Ethernet/IP cable shall be UL Listed and have an insulating rating of 600V, i.e., no special separation, barriers, or internal conduit is required for the Ethernet/IP conductors.
- 2. The addition or removal of a unit from the Ethernet/IP system shall not interrupt the operation of other units within the system.

C. Ethernet/IP Cable Layout

- 1. An Ethernet/IP trunkline shall be routed through the MCC line-up, behind barriers that isolate the trunkline from the unit space and wireways to prevent accidental mechanical damage during MCC installation.
- 2. Ethernet/IP ports shall be provided in the rear of each vertical wireway to simplify installation, relocation, and addition of plug-in MCC units.
- 3. The Ethernet/IP component within each plug-in shall be connected to one of the Ethernet/IP ports in the vertical wireway with cable as outlined above in Section B – Ethernet/IP Cable.

D. Ethernet/IP System Performance

- 1. The Ethernet/IP system shall be designed to operate at 10/100-BASE-T to maximize the system performance.
- 2. The Ethernet/IP system is to be qualified to communicate and perform under normal and adverse MCC electrical environments (e.g., contactor electrical operation, contactor jogging duty, and unit short circuit fault).

E. Ethernet/IP Units

1. Motor Starter Units

- a. Each motor starter shall have an electronic overload relay with the following features:
 - 1) Ethernet/IP communication
 - 2) LEDs for status indication
 - 3) Test/Reset button
 - 4) Adjustable trip class (5 to 30)
 - 5) General purpose I/O (minimum 4 inputs, 3 outputs), rated for 110-120 VAC or 24 VDC as specified on drawing.

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

- 6) Protective functions with programmable trip level, warning level, time delay and inhibit window:
 - a) Thermal overload
 - b) Underload
 - c) Jam
 - d) Current imbalance
 - e) Stall
 - f) Phase loss
 - 7) Current Monitoring Functions:
 - a) Individual Phase currents
 - b) Average current
 - c) Full load current
 - d) Current to Ground
 - e) Current imbalance percent
 - f) Percent thermal capacity utilized
 - 8) Diagnostic Information:
 - a) Device status
 - b) Warning status
 - c) Time to reset
 - d) Trip status
 - e) Time to overload trip
 - f) History of last five trips
- b. The electronic overload relay is to be an **Allen-Bradley E300**, or equal.
 - c. The module shall be wired as shown on the drawings. If additional I/O is required, when shown on the drawings, it shall utilize a an expansion module having four inputs and two outputs. This module shall be **Allen-Bradley E300 Cat No. 193-EXP-DIO-42-120** or **193-EXP-DIO-42-24D** depending on the voltage required
- F. Programming of Parameters
1. All parameters may be left at the factory default setting.
- G. Testing
1. The interwired Ethernet/IP MCC shall be powered up, configured, and tested in an ISO9001 facility to ensure each unit communicates properly prior to shipment.
- H. Where called for on the drawings, Switchboard matting shall be high-voltage, 1/4-inch thick, 36 inches deep, the full width of the MCC, and shall be Model M36 as manufactured by **W.H. Salisbury & Co.**, or equal.

2.10 FACTORY TESTS

- A. All motor control centers and their components shall be given manufacturer's standard electrical and mechanical production tests and inspections. The tests shall include electrical continuity check, dielectric tests for each circuit, and inspection for proper functioning of all components, including controls, protective devices, metering, and alarm devices.

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

2.11 SPARE PARTS

- A. The CONTRACTOR shall furnish the following for each MCC:
 - 1. Three bezels of each color installed for pilot indicators
 - 2. One dozen panel lamps
 - 3. One dozen control fuses of each size installed
- B. Spare parts shall be identified by MCC number, type, size, and manufacturer.

2.12 MANUFACTURERS, OR EQUAL

- A. Motor control centers shall be **Allen-Bradley “Centerline 2100,”** or equal.

PART 3 -- EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall install motor control centers in accordance with manufacturer's published instructions. Conduit installation shall be coordinated with manufacturer's as-fabricated drawings so that all conduit stub-ups are within the area allotted for conduit. Conduit shall be stubbed up in the section that contains the devices to which conductors are terminated.
- B. The CONTRACTOR shall install motor control centers in place of existing motor control centers while maintaining continued facility operation.
- C. The CONTRACTOR shall install new conductors from the service to the MCC and from the automatic transfer switch to the MCC, unless otherwise noted on the drawings.
- D. If stored at the Site, motor control centers shall be stored in a clean, dry space. Factory wrapping shall be maintained or an additional heavy plastic cover shall be provided to protect units from dirt, water, construction debris, and traffic. Storage space shall be heated or MCC space heaters shall be energized.
- E. Motor control centers shall be handled carefully to avoid damage to motor control center components, enclosure, and finish. Damage shall be repaired before installation.

3.2 INSTALLATION

- A. Motor control centers shall be installed on the existing 3-1/2-inch concrete pads. The CONTRACTOR shall be responsible for providing the additions to concrete pads where called for on the Plans or required by manufacturer's installation requirements. Any existing pads are either to be removed or integrated into the new pad. No exposed concrete “lip” is to be left that presents a safety hazard. After leveling and shimming, the CONTRACTOR shall anchor motor control centers to concrete pads, and shall grout so that no space exists between the pad and support beams.
- B. The CONTRACTOR shall:

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

1. Torque all bus bar bolts to manufacturer's recommendations. Tighten all sheet metal and structure assembly bolts.
2. Adjust all Motor Circuit Protector (MCP) devices to the instantaneous trip setting position recommended for the actual horsepower and full load amps of the motor. Verify that overload devices are proper for equipment installed; make necessary changes in overload devices as required for motors having power factor correcting capacitors. This work shall be coordinated with requirements of Specification Section 26 05 73 – Protective Device Study.
3. After equipment is installed, touch up scratches and verify that nameplate, and other identification is accurate.
4. Provide high voltage switchboard matting in front of the MCC.

3.3 FIELD TESTS

- A. Visual and mechanical inspection after installation
 1. Inspect for physical damage, proper anchorage, and grounding.
 2. Verify that the ratings of the thermal overload heaters match the motor full-load current nameplate data.
 3. Check tightness of bolted connections.
- B. Electrical Tests
 1. Insulation tests
 - a. Measure insulation resistance of each bus section phase to phase and phase to ground for 1 minute. Test voltage and minimum acceptable resistance shall be in accordance with manufacturer's recommendations. Submit manufacturer's testing recommendations to the ENGINEER prior to performing tests.
 - b. Measure insulation resistance of each starter section phase to phase and phase to ground with the starter contacts closed and the protective device open. Test voltage and minimum acceptable resistance shall be in accordance with the manufacturer's recommendations.
 - c. Measure insulation resistance of each control circuit with respect to ground.
 - d. Record all readings and include in the Operating and Maintenance manual.
 2. Undertake phase sequence test to verify phasing.
 3. Verify proper operation of control logic in all modes of control.

3.4 STARTUP / FINAL

1. Contractor shall provide a Factory Representative for Startup of all of the assemblies within the MCC. Representative will work with all related trades to provide a coordinated control and power distribution system
2. After system has had any repairs/modification completed, Contractor shall clean all debris in the MCC and repair / touch up any cosmetic damage.

END OF SECTION

SECTION 26 24 19 – LOW VOLTAGE MOTOR CONTROL CENTERS

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SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 -- GENERAL

1.1 SUMMARY

- A. This Section describes general requirements, products, and methods of execution relating to overcurrent protective devices approved for use on this project. Type, duty rating and characteristics, fault interrupting capability and coordination requirements shall be determined from the plans.

1.2 RELATED WORK

- A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to this work. It is the Contractor's responsibility to perform all the work required by the Contract Documents.

- 1 Division 26 05 00 – Electrical Work, General

1.3 SUBMITTALS

- A. In accordance with the requirements of Division 01, submit the following Project Data:

- 1 Descriptive literature bulletins, and catalog cuts of the equipment.
 - 2 Materials of construction.
 - 3 Complete wiring diagrams.
 - 4 Complete installation instructions, with points of electrical connection requirements clearly shown.
 - 5 Performance curves.

1.4 QUALITY ASSURANCE

- A. Devices shall be the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with applicable standards and UL listed.

PART 2 -- PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKERS

- A. Molded case circuit breakers shall be suitable for individual as well as panelboard mounting. They shall be bolt-on type, unless "plug-on" type specifically allowed.
- B. Circuit breaker sizes and configurations shall be as shown on the drawings.
- C. The breakers shall meet NEMA and/or UL specifications as applicable to frame and size, standard rating and interrupting capability. Breakers installed in panelboards shall have short circuit interrupt ratings that match those of the panelboard.
- D. The breakers shall be one-, two-, or three-pole as scheduled, operate manually for normal ON-OFF switching and automatically under overload and short circuit conditions.

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- E. Operating handle shall open and close all poles simultaneously on a multi-pole breaker. Operating mechanism shall be trip-free so that contacts cannot be held closed against abnormal overcurrent or short circuit condition.
- F. Electronic Trip Units: Microprocessor based trip units shall display breaker status. Trip units shall include LED trip indicators, ERMS, ability to monitor Amps, Voltage, Power, Energy and Harmonics as a network. Trip units shall be upgradable by uploading Digital Modules without the need to replace or modify the trip unit hardware. Trip units shall contain the following field adjustable settings:
 - 1 Instantaneous trip
 - 2 Long time and short time pickup levels
 - 3 Long time and short time time adjustments with I²t response
 - 4 Ground fault pickup level, time delay, and I²t response

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Size devices as required by the load being served or as shown on the drawings.

END OF SECTION

SECTION 26 29 23 – VARIABLE FREQUENCY DRIVE UNITS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. General: The CONTRACTOR shall provide variable frequency drive (VFD) units, complete and operable, in accordance with the Contract Documents. It is the intent of this Section to require complete, reliable, fully tested variable frequency drive systems suitable for attended or unattended operation.
- B. The requirements of Section 26 05 00 – Electrical Work, General, and Section 26 24 19 – Low Voltage Motor Control Centers, apply to the WORK of this Section.
- C. Single Manufacturer: Like products shall be the end product of one manufacturer in order to standardize appearance, operation, maintenance, spare parts, and manufacturer's services. This requirement, however, does not relieve the CONTRACTOR of overall responsibility for the WORK.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Div. 01 and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings: Shop Drawings shall include the following information:
 - 1. Equipment information
 - a. Name of drive manufacturer
 - b. Type and model with complete catalog number and explanation
 - c. Assembly drawing and nomenclature
 - d. Maximum heat dissipation capacity in kW
 - 2. Enclosure rating.
 - 3. Operator interface information
 - 4. Conduit entrance provisions.
 - 5. Circuit breaker type and rating requirements.
 - 6. UL listing.
- C. The Technical Manual shall contain the following documentation:
 - 1. Manufacturer's 2-year warranty.
 - 2. Field test report.
 - 3. Programming procedure and program settings.
- D. Spare Parts List: Information for parts required by this Section plus any other spare parts recommended by the controller manufacturer.

SECTION 26 29 23 – VARIABLE FREQUENCY DRIVE UNITS

PART 2 -- PRODUCTS

2.1 GENERAL

- A. The CONTRACTOR shall provide variable frequency drives for the following centrifugal pumps:

Facility	Equipment	Enclosure	Pump HP	Drawing
Outer Dive PS	Pump P-101	NEMA 12	45	E-302
Outer Dive PS	Pump P-102	NEMA 12	175	E-302
Outer Dive PS	Pump P-103	NEMA 12	45	E-302
West Juneau PS	Pump P-201	NEMA 12	85	E-303
West Juneau PS	Pump P-202	NEMA 12	85	E-303

- B. The CONTRACTOR shall provide variable frequency drives as shown on the Drawings.

2.2 EQUIPMENT

A. VFD

- 1. Shall be an adjustable frequency inverter
 - a. Designed to operate at 480V 3 phase, 60 Hertz power to a DC voltage and then to adjustable frequency 3-phase AC by use of a 3-phase inverter as shown on the drawings.
 - b. The inverter shall be a voltage source design producing a pulse-width-modulated type output.
 - c. Inverters shall be designed to operate 3-phase, 60 Hertz, NEMA-B, open drip-proof (1.15 SF) or TEFC (1.15 SF), squirrel-cage high efficiency inverter duty induction motors over the range of 50-100 percent of base speed without derating (other than for single phase source) or requiring any motor modifications.
 - d. Inverters shall be capable of delivering nameplate horsepower exclusive of service factor without the need for mandatory thermostats or feedback tachometers.
 - e. The VFD shall vary both the AC voltage and frequency simultaneously to operate the motor at required speeds.
 - f. Current source inverters will not be acceptable.
 - g. Inverters shall be sized to match the KVA and inrush characteristics of the motors.
- 2. The CONTRACTOR shall be responsible for matching the controller to the load (variable torque) as well as the speed and current of the actual motor being controlled.

- B. NEMA 4X Enclosure: Not used.

- C. NEMA 1 Enclosure: Drives shall be mounted within a NEMA 1 motor control center.

- D. The minimum VFD inverter efficiency shall be 95 percent at 100 percent speed and load, and 85 percent at 50 percent speed and load.

SECTION 26 29 23 – VARIABLE FREQUENCY DRIVE UNITS

- E. The VFD shall shut down in an orderly manner when a power outage occurs on one or more phases. Upon restoration of power and a "start" signal, the motor shall restart and run based on the VFD programmed pumping sequence. See the control narrative on the Drawings for additional information.
- F. The VFD shall be provided with additional features described below:
1. Inrush current adjustment between 50 and 110 percent of motor full load current (factory set at 100 percent).
 2. Overload capability at 110 percent for 60 seconds for variable torque loads.
 3. Adjustable acceleration and deceleration.
 4. On loss of input signal, the VFD shall operate at a preset speed or hold last state at time of signal loss. The intent is for the VFD to enter a programmed ramp down sequence during a loss of input signal.
 5. A minimum of 2 selectable frequency jump points to avoid critical resonance frequency of the driven system.
 6. 3 percent line reactor on the output when indicated on the drawings.
- G. Protection: The VFD shall have, as a minimum, the following protection features:
1. Input line protection provided with metal oxide varistor (MOV) and RC network.
 2. Protection against single phasing.
 3. Instantaneous overcurrent protection.
 4. Electronic overcurrent protection.
 5. Ground fault protection.
 6. Overtemperature protection for electronics.
 7. Protection against internal faults.
 8. Ability to start into rotating motor (forward or reverse rotation).
 9. Additional protection and control as indicated and as required by the motor and driven equipment.
- H. Service Conditions: The VFD shall be designed and constructed to satisfactorily operate within the following service conditions.
1. Ambient temperature: 0 to 40 degrees C
 2. Humidity: 0 to 95 percent, non-condensing
 3. AC line voltage variation: plus 10 percent to minus 10 percent.
 4. AC line frequency variation: plus and minus 2 hertz.
- I. Operator Interface: The drive shall have an operator interface with LCD display and full numeric keypad. The operator interface shall be accessible from the front of the enclosure without opening any doors.
- J. Ethernet/IP Interface: The inverter signal circuits shall be isolated from the power circuits and be designed to accept a Ethernet/IP interface. The drive automatically communicates with Allen-Bradley programming software to address the drive upon Ethernet/IP connection. The inverter shall follow the setting of a local control when in the hand mode. The following operator monitoring and control devices for the inverter shall be provided on the face of the VFD enclosure, either as discrete devices, or as part of a multi-function microprocessor-based keypad access device. Access to set-up and protective adjustments shall be protected by key-lockout or password.

SECTION 26 29 23 – VARIABLE FREQUENCY DRIVE UNITS

1. All available programming parameters must be addressable from Logix5000 over the Ethernet/IP network without the use of protocol convertors or bridges.
 2. Auto/Hand selection from the operator interface. In "Auto", the inverter shall operate from the Ethernet/IP input, and in "Hand" control, shall operate on ethernet/IP from the local keypad.
 3. Speed indicator calibrated in percent speed
 4. Inverter fault trip indication and output alarm contacts
 5. Trip reset pushbutton
 6. Electronic overload protection.
- K. Properly identified screw type terminal boards shall be provided for interconnection to remote controls. Factory wiring to terminal boards shall be provided.
- L. I/O Option Module: The CONTRACTOR shall provide a 24vdc I/O Module with the following features:
1. Compatible with the VFD specified herein
 2. Two (2) analog inputs
 3. Two (2) analog outputs
 4. Six (6) discrete inputs
 5. Two (2) relay outputs
 6. No jumpers or switches shall be required to configure the digital inputs and outputs
 7. I/O Options Modules shall be **Allen-Bradley PF750 24V I/O Module Cat No. 20-750-2262C-2R**
 8. I/O Option Module shall be factory wired to a terminal strip within the VFD/MCC enclosure for field wiring to remote devices.
- M. Power Terminal Guard: The CONTRACTOR shall provide **Allen-Bradley Power Terminal Guard Cat No. 20-750-PTG1-F6** for additional protection of VFD power terminals.

2.3 POWER CONDITIONING

- A. Where shown on the drawings the CONTRACTOR shall provide:
1. Line Reactor: Line reactors shall be designed for use as output filters for AC-PWM VFDs. The windings shall be copper with 600VAC Class H insulation, bobbin construction, laminated iron core, and rated for 200 percent capacity for 3 minutes. The reactors shall be enclosed in a NEMA 1 enclosure and include wire terminals and be UL-listed. The reactors shall be **Trans-Coil Inc. Model KLR**, or equal.
 2. Load Reactors
 - a. For lead lengths less than 100 feet **TransCoil Inc. Model KDR**
 - b. For Lead Lengths 100 feet and over **TransCoil Inc. Model V1K**

2.4 SPARE PARTS

- A. The CONTRACTOR shall furnish the spare parts listed below, suitably packaged and labeled with the corresponding equipment number.
- B. The following spare parts shall be furnished:

SECTION 26 29 23 – VARIABLE FREQUENCY DRIVE UNITS

1. Three (3) sets of spare fuses of each size.
2. One (1) spare keypad access device (HIM).
3. The OWNER currently has spare parts for Allen-Bradley VFD units. Unless the CONTRACTOR is providing Allen-Bradley VFD units, the CONTRACTOR shall provide 10% spares of the VFD units installed under this Contract and at least one (1) VFD of each size.

2.5 MANUFACTURERS

- A. The variable frequency drive units shall be **Allen-Bradley Powerflex 753**, or equal.
- B. Panel size is based on Allen-Bradley drives. CONTRACTOR shall make all necessary modifications required for other drives.

PART 3 -- EXECUTION

3.1 SERVICES OF MANUFACTURER

- A. General: An authorized service representative of the manufacturer shall be present at the site as necessary to furnish the inspection, startup, and field adjustment services listed below.
- B. Inspection, Startup, Field Adjustment: The authorized service representative shall supervise the following and certify the equipment and controls have been properly installed, aligned, and readied for operation.
 1. Installation of the equipment
 2. Inspection, checking, and adjusting the equipment
 3. Startup and field testing for proper operation
 4. Performing field adjustments such that the equipment installation and operation comply with requirements.
- C. Instruction of OWNER's Personnel: The authorized representative shall instruct the OWNER's personnel in the operation and maintenance of the equipment, including step by step troubleshooting with test equipment. Instruction shall be specific to the VFD models provided.
- D. Telephone Support: The drive Manufacturer shall provide one (1) year of telephone technical support for the Owner during normal business hours. The technical support shall include the drive, HIM, and Ethernet/IP network, and shall start on the date of substantial completion.

3.2 INSTALLATION

- A. Conduit stub-ups for interconnected cables and remote cables shall be located and terminated in accordance with the drive manufacturer's recommendation.
- B. The CONTRACTOR shall perform programming of drive parameters required for proper operation of the VFD's included in this project. Submit records of programming data in the equipment Technical Manual, including setup and protective settings

SECTION 26 29 23 – VARIABLE FREQUENCY DRIVE UNITS

3.3 FIELD TESTING

- A. Testing, checkout, and startup of the VFD equipment in the field shall be performed under the technical direction of the manufacturer's service engineer. Under no circumstances shall any portion of the drive system be energized without authorization from the manufacturer's representative.

END OF SECTION

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCH

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer switch shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

1.2 CODES AND STANDARDS

- A. The automatic transfer switches and controls shall conform to the requirements of:
 - 1. UL 1008 - Standard for Transfer Switch Equipment
 - 2. NFPA 70 - National Electrical Code
 - 3. NFPA 110 - Emergency and Standby Power Systems
 - 4. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - 5. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
 - 6. UL 508 Industrial Control Equipment

PART 2 -- PRODUCTS

2.1 MECHANICALLY HELD TRANSFER SWITCH

- A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.
- B. The switch shall be positively locked and unaffected by momentary outages. All main contacts shall be silver composition. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.
- C. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching, or transfer between two active power sources, are not acceptable.

2.2 MICROPROCESSOR CONTROLLER

- A. The controller's sensing and logic shall be provided by a single built-in microprocessor.

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCH

- B. A single controller shall provide twelve selectable nominal voltages. Voltage sensing shall be true RMS type and shall be accurate to $\pm 1\%$ of nominal voltage. Frequency sensing shall be accurate to $\pm 0.2\%$. The panel shall be capable of operating over a temperature range of -20 to +60 degrees F and storage from -55 to +85 degrees F.
- C. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit.
- D. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
- E. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1. EN 55011:1991 Emission standard - Group 1, Class A
 - 2. EN 50082-2:1995 Generic immunity standard, from which:
 - EN 61000-4-2:1995 Electrostatic discharge (ESD) immunity
 - ENV 50140:1993 Radiated Electro-Magnetic field immunity
 - EN 61000-4-4:1995 Electrical fast transient (EFT) immunity
 - EN 61000-4-5:1995 Surge transient immunity
 - EN 61000-4-6:1996 Conducted Radio-Frequency field immunity
 - 3. IEEE472 (ANSI C37.90A) Ring Wave Test.

2.3 ENCLOSURE

- A. The ATS shall be furnished with a NEMA 12 rated, lockable, dead front enclosure unless otherwise shown on the Contract Drawings.
- B. There are no penetrations allowed in door.

2.4 CONTROLLER DISPLAY AND KEYPAD

- A. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters.

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCH

2.5 VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

- A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal):

<u>Parameter</u>	<u>Sources</u>	<u>Dropout / Trip Pickup / Reset</u>	
Undervoltage	N&E,3φ	70 to 98%	85 to 100%
Overvoltage	N&E,3φ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

- B. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
- C. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).
- D. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

2.6 TIME DELAYS

- A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.
- B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
- C. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails, and the normal source is acceptable.
- D. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
- E. All time delays shall be adjustable in 1 second increments using the LCD display and keypad.

2.7 ADDITIONAL FEATURES

- A. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCH

- B. Auxiliary contacts rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source. Additional auxiliary contacts shall be provided where required and as shown on the Plans.
- C. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- D. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
- E. An inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer.
- F. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.
- G. Self-Diagnostics: The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- H. Communications Interface: The controller shall be capable of interfacing through an Ethernet/IP interface and an optional serial communication module.
- I. Data Logging: The controller shall have the ability to log time and date stamped data and to maintain the last 99 events in the event of total power loss, including:
 - 1. Event Logging
 - a. Data and time and reason for transfer normal to emergency.
 - b. Data and time and reason for transfer emergency to normal.
 - c. Data and time and reason for engine start.
 - d. Data and time engine stopped.
 - e. Data and time emergency source available.
 - f. Data and time emergency source not available.
 - 2. Statistical Data
 - a. Total number of transfers.
 - b. Total number of transfers due to source failure.
 - c. Total number of days controller is energized.
 - d. Total number of hours both normal and emergency sources are available.

2.8 WITHSTAND AND CLOSING RATINGS

- A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. This

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCH

requirement shall be coordinated with the requirements of Section 26 05 73 – Protective Device Study.

- B. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings.

2.9 ACCEPTABLE MANUFACTURERS

- A. Automatic transfer switches shall be **ASCO 7000 Series**, or equal.

2.10 DEVICES

- A. Provide the following transfer switches:

Facility	Description
Outer Drive PS	600A, 480Y/277V, 3-Phase, 4-W
West Juneau PS	400A, 480Y/277V, 3-Phase, 4-W

PART 3 -- EXECUTION

3.1 TESTS AND CERTIFICATION

- A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- B. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation, and servicing in accordance with ISO 9001.

END OF SECTION

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCH

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SECTION 26 43 13 – SURGE PROTECTION FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 -- GENERAL

1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for surge protection for low voltage electrical power circuits as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:
 - 1. Requirements for integrated SPDs (installed from the factory) for low voltage power

1.2 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. ANSI/IEEE C62.41.1, "Guide on the Surges Environment in Low Voltage (1000 V and Less) AC Power Circuits."
 - 2. ANSI/IEEE C62.41.2, "Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits."
 - 3. ANSI/IEEE C62.45, "Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits."
- C. International Organization for Standardization (ISO):
 - 1. ISO 9001, "Quality Management Systems - Requirements."
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70, "National Electrical Code," hereinafter referred to as NEC.
- E. Underwriters Laboratories, Inc. (UL):
 - 1. UL 67, "Standard for Panelboards."
 - 2. UL 96A, "Standard for Installation Requirements for Lightning Protection Systems."
 - 3. UL 845, "Motor Control Centers."
 - 4. UL 857, "Busways."
 - 5. UL 891, "Switchboards."
 - 6. UL 1283, "Standard for Safety for Electromagnetic Interference Filters."
 - 7. UL 1449, "Standard for Surge Protective Devices."
 - 8. UL 1558, "Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear."

SECTION 26 43 13 – SURGE PROTECTION FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

1.3 DEFINITIONS

- A. $I_{(n)}$: Nominal discharge current rating.
- B. MCOV: Maximum continuous operating voltage.
- C. Protection Modes: The pair of electrical connections where the VPR applies.
- D. MOV: Metal oxide varistor; an electronic component with a significant non-ohmic current voltage characteristic.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short circuit current rating.
- G. SPD: Surge protective device.
- H. VPR: Voltage protection rating.

1.4 SYSTEM DESCRIPTION

- A. General SPD Requirements:
 - 1. SPD with accessories shall be listed and labeled as defined in NEC, by UL, and marked for intended location and application.
 - 2. Comply with UL 1449.
 - 3. Comply with UL 1283 (applies to Type 2 SPDs).
 - 4. Design in accordance with ANSI/IEEE C62.41.1, ANSI/IEEE C62.41.2, and ANSI/IEEE C62.45.
 - 5. SPDs manufacturer shall be ISO 9001 certified.
 - 6. MCOV of the SPD shall not be less than 115 percent for 480Y/277V and 125 percent for 240/120V nominal RMS system voltages.
 - 7. SPDs installed internal to the distribution equipment shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified to the following UL standards:
 - a. Panelboards: UL 67.
 - b. Motor Control Centers: UL 845.
 - c. Busway: UL 857.
 - d. Switchboards: UL 891.
 - e. Switchgear: UL 1558.

1.5 SUBMITTALS

- A. General: See Div. 01 – Contractor Submittals.
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.
 - 1. For each type of product indicated include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

SECTION 26 43 13 – SURGE PROTECTION FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

2. Provide verification the SPD is listed or recognized through UL to the latest safety standard, UL 1449.
- C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data.
- D. Operation and Maintenance Data: Submit operation and maintenance data for surge protection for low voltage electrical power circuits to include in operation and maintenance manuals.
- E. Warranty Data: Submit sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of surge protection for low voltage electrical power circuits of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
 2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing surge protection for low voltage electrical power circuits similar in type and scope to that required for this Project and shall be approved by the manufacturer.
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
- C. Single Source Responsibility: Obtain surge protection for low voltage electrical power circuits and required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work. Any materials which are not produced by the manufacturer shall be acceptable to and approved by the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 WARRANTY

- A. Special Warranty: Submit a written warranty executed by the manufacturer, the Installer, and the Contractor, agreeing to repair or replace surge protection for low voltage electrical power circuits that fail in materials or workmanship within the specified warranty period.
 1. Warranty Period: Warranty period shall be 10 years from date of Substantial Completion.

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PART 2 -- PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Product specified is “Surgeologic Surge Protection” as manufactured by Square D by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Engineer will be the sole judge of the basis of what is equivalent.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. SPDs: Comply with UL 1449.
 - 1. SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. SPDs installed on the load side of the service entrance OCPD shall be either Type 1 or Type 2 SPDs.
 - 2. Type 2 SPDs shall also comply with UL 1283.
- B. Features and Accessories: SPDs shall provide the following features and accessories:
 - 1. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.
 - 2. Indicator light(s) display for power and protection status with push-to-test capabilities.
 - 3. Audible alarm with silencing switch.
 - 4. Form C contacts; one normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - 5. Surge counter with reset switch.
 - 6. Optional integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.
- C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its category/location, as follows:

<u>Category/Location</u>	<u>Application</u>	<u>Per Phase</u>	<u>Per Mode</u>
C	Service Entrance	240 kA	120 kA
B	Distribution	160 kA	80 kA

- D. Protection Modes:
 - 1. UL 1449 VPR for grounded WYE configured circuits shall not exceed the following:

<u>Modes</u>	<u>208Y/120</u>	<u>480Y/277</u>	<u>600Y/347</u>
L-N; L-G; N-G	800 volts	1200 volts	1500 volts
L-L	1200 volts	2000 volts	2500 volts

- 2. UL 1449 VPR for Delta configured circuits shall not exceed the following:

<u>Modes</u>	<u>240D</u>	<u>480D</u>	<u>600D</u>
L-G; N-G	1200 volts	2000 volts	2500 volts

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- E. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.
- F. Nominal Discharge Current Rating: 20 kA $I_{(n)}$.
 - 1. Surge protective devices located at service entrance locations shall carry a minimum nominal discharge current rating of 20 kA to meet the requirements of UL 96A.

2.3 DISTRIBUTION/ BRANCH PANEL SUPPRESSORS

- A. SPDs: Comply with UL 1449.
 - 1. Type 1 or Type 2 SPDs.
 - 2. Type 2 SPDs shall also comply with UL 1283.
- B. Features and Accessories: SPDs shall provide the following features and accessories:
 - 1. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.
 - 2. Indicator light(s) display for power and protection status.
 - 3. Audible alarm with silencing switch.
 - 4. Form C contacts; one normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - 5. Surge counter with reset switch.
 - 6. Optional integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.

- C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its category/location, as follows:

<u>Category/Location</u>	<u>Application</u>	<u>Per Phase</u>	<u>Per Mode</u>
B	Distribution	160 kA	80 kA
B	Branch	120 kA	60 kA

- D. Protection Modes:
 - 1. UL 1449 VPR for grounded WYE configured circuits shall not exceed the following:

<u>Modes</u>	<u>208Y/120</u>	<u>480Y/277</u>	<u>600Y/347</u>
L-N; L-G; N-G	800 volts	1200 volts	1500 volts
L-L	1200 volts	2000 volts	2500 volts

- 2. UL 1449 VPR for Delta configured circuits shall not exceed the following:

<u>Modes</u>	<u>240D</u>	<u>480D</u>	<u>600D</u>
L-G; N-G	1200 volts	2000 volts	2500 volts

- E. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.

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F. Nominal Discharge Current Rating: 10 kA $I_{(n)}$.

2.4 ENCLOSURES

- A. Enclosure shall meet or exceed the ratings for the environment to be installed as indicated on drawings.
 - 1. Indoor Enclosures for Externally Mounted SPDs: NEMA 250, Type 3R.
 - 2. Outdoor Enclosures for Externally Mounted SPDs: NEMA 250, Type 3R, 4X.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 INSTALLATION

- A. Install surge protection for low voltage electrical power circuits in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- B. Install SPD devices at the service entrance in accordance with NEC. SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. SPDs installed on the load side of the OCPD shall be either Type 1 or Type 2 SPDs.
- C. Follow manufacturer's recommended installation practices.
 - 1. Provide a minimum 30 ampere circuit breaker as a dedicated disconnecting means for the SPD unless otherwise indicated.
 - 2. Install SPDs with properly rated conductors between suppressor and points of attachment as short and straight as possible; adjust circuit breaker positions to achieve shortest and straightest leads.
 - 3. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
 - 4. Twist input conductors together to reduce the input inductance.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 45 00 - Quality Control.
- B. Perform the following tests and inspections.
 - 1. Compare equipment nameplate data for compliance with the Drawings and the Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.

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3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- C. A SPD will be considered defective if it does not pass inspections.
- D. Prepare inspection reports.

3.4 DEMONSTRATION

- A. Start-Up Service:
 1. Complete start-up checks according to manufacturer's written instructions.
 2. Do not perform insulation resistance tests of the distribution wiring equipment with SPDs installed. Disconnect all wires, including, but not limited to, neutral of the SPD before conducting insulation resistance tests, and reconnect them immediately after the testing is over.
 3. Energize SPDs after power system has been energized, stabilized, and tested.

3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer that shall ensure that the surge protection for low voltage electrical power circuits shall be without damage at time of Substantial Completion.

END OF SECTION

**SECTION 26 43 13 – SURGE PROTECTION FOR LOW VOLTAGE ELECTRICAL
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**SECTION 33 01 30.72 – REHABILITATION BY ULTRAVIOLET LIGHT CURED-IN-PLACE
PIPE**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work consists of furnishing all labor, equipment, materials, and incidentals required to rehabilitate existing sewer mains by the installation of ultraviolet light cured-in-place pipe (CIPP) into the existing main. Work will include bypass pumping, pipe cleaning, closed circuit television (CCTV) inspection of pipeline to be lined, installation of liner, reconnection of service connections, if applicable, final (CCTV) inspection, traffic control, public outreach, and all other related work. All such work shall comply with these specifications and the specific product manufacturer's recommendations. Any conflict between the product manufacturer's recommendations and any portion of the contract documents shall be resolved with the Owner and Engineer prior to proceeding with the work. The location and nominal size of sewer main rehabilitation by CIPP methods are shown on the project drawings.

1.2 RELATED WORK

- A. SECTION 09 97 00 – Special Coatings
- B. SECTION 40 05 00 – Common Work Results for Piping, General
- C. SECTION 011537.1 – Bypass Pumping

1.3 REFERENCE STANDARDS

- A. American Society of Testing and Material (ASTM)
 - 1. D 543 – Standard Test Methods for Resistance of Plastics to Chemical Reagents.
 - 2. D 638 – Standards Test Methods for Tensile Properties of Plastics.
 - 3. D 790 – Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - 4. D 792 – Standard Test Methods for Density and Specific Gravity of Plastics by displacement.
 - 5. F 1216 – Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of Resin-Impregnated Tube.
 - 6. F 1743 – Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe.
 - 7. D 2122 – Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings
 - 8. F 2019 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in place installation of Glass Reinforced Plastic Cured-in-Place Using the UV Light Curing Method.
 - 9. D2990 – Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.

These standards are a part hereof by such reference and shall be the latest edition and revision thereof. In the case of conflicting requirements between this specification and these referenced documents, this specification shall govern.

1.4 PRODUCT QUALIFICATIONS

- A. Products used in the work of this section shall be produced by manufacturers regularly engaged in the manufacture of cured-in-place liners for municipal wastewater and stormwater systems and with

SECTION 33 01 30.72 – REHABILITATION BY ULTRAVIOLET LIGHT CURED-IN-PLACE PIPE

a history of successful production acceptable to the owner.

- B. Products shall meet the following criteria: A minimum of 250,000 linear feet of successful wastewater or stormwater collection system installations in the U.S. must be documented to the satisfaction of the Owner and Engineer. Additionally, a minimum of five (5) successful wastewater or stormwater collection system projects of a similar size and scope of work shall be performed in the U.S. and documented to the satisfaction of the Owner and Engineer to assure commercial viability.

1.5 INSTALLER QUALIFICATIONS

- A. The installer shall have at least three (3) years active experience in the commercial installation of the product bid. In addition, the installer must have successfully installed at least 50,000 feet of the product bid in wastewater or stormwater collection systems. The Contractor shall submit a complete list of installer qualifications and complete work history for the field superintendent who will be on site for the duration of the project.

The installing Contractor shall be licensed by the cured-in-place lining system manufacturer and shall have successful experience in the installation of cured-in-place lining systems in municipal wastewater or stormwater systems. The Contractor shall also be familiar with the specified requirements and the methods needed for proper performance of the work of this section.

- B. Superintendent:

- 1. The entire pipe lining project shall be field supervised by a project superintendent with the following lining installation and supervisory experience. This installation experience shall be with the specific liner system and type proposed: three (3) successfully completed projects within the past 1½ years amounting to at least 2,000 linear feet of 24” and larger pipe per project; and at least one year bypass pumping supervisory field experience.

1.6 QUALITY ASSURANCE

- A. The finished liner shall be continuous over the entire length of the liner insertion run between the manholes and shall be free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination.
- B. Wrinkles in the finished liner pipe which cause a backwater of one inch or more or reduce the hydraulic capacity of the pipe are unacceptable and shall be removed or repaired by the Contractor. If a void between the wrinkle and the pipe develops, the Contractor shall repair or replace that section of the pipe. Methods of repair shall be proposed by the Contractor and submitted to the owner for review. Minor internal diameter reductions in the liner where the liner passes through pipe repair bands are allowable provided a smooth transition along the pipe is ensured, and the reduction does not cause a backwater of more than one inch.
- C. Following pipeline cleaning and prior to installation of liner and finish work at the manholes, the pipeline shall be televised and recorded in digital format acceptable to the Engineer, such as DVD or USB drive, and shall be provided to the Engineer. The Contractor shall also televise the pipeline after completion of all liner insertion and finish work at the manholes. All (CCTV) work is to be

SECTION 33 01 30.72 – REHABILITATION BY ULTRAVIOLET LIGHT CURED-IN-PLACE PIPE

completed per a national standard for pipeline inspections.

1.7 SUBMITTALS

A. After notification of award, the Contractor shall provide the following information:

1. A comprehensive construction sequencing plan. At a minimum the plan shall include the following (if applicable):
 - a. Proposed schedule
 - b. Identification of set-up locations for lining installation
 - c. Lining procedures including UV light train
 - d. Bypass pumping plan
 - e. Dewatering plan (if dewatering is deemed necessary by the Contractor)
 - f. Traffic control plan
 - g. Pollution control plan.
2. Letter identifying the crew members performing the lining.
3. Liner manufacturer's certification that personnel involved in installation of the pipe liner have successfully completed training in handling, jointing, insertion, trimming, reinstatement of service connections, and finishing of pipe liner.
4. Calculations supporting recommended liner thicknesses. See 2.1.C of this specification for additional requirements.
5. Certified test reports demonstrating that the exact resin/liner combination to be used for this project meets the requirements for initial structural properties (performed in accordance with ASTM F2019, ASTM F1216, ASTM D638, and ASTM D790 or equivalent as approved) and chemical resistance (per ASTM F1216-Appendix X2). The initial data between time "0" and "1,000" hours must be excluded. If the architecture of the UV-CIPP is such that the physical properties vary depending on the direction of testing (i.e., axial versus circumferential), submit test data on both directions in accordance with the test methods listed above in this paragraph.

B. Prior to initiation of the liner work, the Contractor shall submit the following information:

1. Shop drawings and product data for the rehabilitation method including a report outlining the process to be used in the rehabilitation of the pipeline(s). The report shall also include information specific to the job, such as coordination issues, access, timing, manufacturer's installation instructions and bypass pumping.
2. Infrared spectrum analysis for proposed resin and confirmation of the resins meeting ASTM D 5813.
3. Installation plan with detailed description of the pipelining installation and curing process including staging and insertion locations. Include materials and equipment (e.g., UV light train) to be utilized and list of tasks associated with each installation. The description must include the resin manufacturer's curing cycle with temperatures and pressure requirements measured continuously and recorded at intervals no less frequently than every 5 minutes. The curing cycle

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must be specific to each liner segment and address project design parameters and site conditions. If possible, include a contingency curing cycle in the event temperatures fall over or under the liner system manufacturer's recommendations. Identify in the description the type of temperature sensors that will be used, their proposed locations, and recording method and/or equipment.

Include a control protocol according to Section 6.7 of ASTM F2019 for each installation. The control protocol must include certification of approval by the liner manufacturer, including the following minimum information:

- a. Date and time
 - b. Length of liner
 - c. Location of installation
 - d. Curing speed
 - e. Light sources and wattage
 - f. Inner air pressure
 - g. Exothermic (curing) temperature
4. Certification from resin manufacturer regarding resin.
 5. Certification from resin manufacturer regarding approval of resin dye quantity and type.
 6. Information on the maximum allowable tensile stress for the tube from the felt manufacturer.
 7. The Contractor shall furnish Material Safety Data Sheets for all appropriate materials to be used in the project.
 8. All measurements made by the Contractor to verify length and diameter of pipe prior to ordering of material.
 9. One complete set of DVDs/USB drive from each of the pre-installation television inspections performed.
- C. Results of field quality control monitoring, laboratory testing of field samples and video inspections:
1. Curing logs showing temperature and pressure readings.
 2. Results of field sample testing as specified in Section 3.04.
 3. One complete set of DVDs/USB drive and log from each of the post-installation television inspections performed as specified in Section 3.5.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Care shall be taken in shipping, handling, and storage to avoid damaging the liner. Extra care shall be taken during extreme heat or extreme cold weather construction. Any liner damaged in

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shipment shall be replaced as directed by the Engineer.

- B. Any liner showing a split or tear, or which has received a blow that may have caused damage, even though damage may not be visible, shall be marked as rejected and removed at once from the job site.
- C. The liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. Extra care shall also be taken in hot weather construction. The liner shall be protected from UV light prior to installation. Any liner showing evidence of premature curing will be rejected for use and will be removed from the site immediately.
- D. Any liner that has a shelf life over six months will be rejected. All liners shall have a record with the date the material was manufactured.

1.9 WARRANTY

- A. The Contractor shall provide the Owner with a warranty to be in force and effect for a period of two (2) years from the date of final acceptance of the project by the Owner. The warranty shall cause the Contractor to repair or replace the liner should failure or damage result from faulty materials or installation. At the end of the warranty period, the Owner may perform a television inspection to confirm the condition of the liner.

PART 2 - PRODUCTS

2.1 CURED-IN-PLACE PIPE (CIPP):

A. General

- 1. This specification provides for the rehabilitation of pipelines by the installation of Cured-in-Place Pipe (CIPP) in accordance with ASTM F 2019 and as modified herein. The cured-in-place pipe shall be a premium, corrosion resistant, polyester, vinyl ester, and photo-initiator catalyst system. Curing is accomplished in accordance with the specified curing schedule supplied by the resin manufacturer or other method approved by the resin manufacturer and the Engineer. Installation of the CIPP shall be performed by a Contractor fully licensed by the lining process manufacturer.

B. Materials

1. Tube:

- a. Furnish tubing that consists of at least two separate tubes of corrosion resistant (E-CR or equivalent) glass fibers according to ASTM D578 and ASTM F2019. The tube will be constructed to withstand installation forces and have sufficient strength to bridge missing pipe. Fabricate the tube to a size that when installed, conforms to the internal circumference and length of the host pipe. Verify pipe diameters prior to ordering tubing. Make allowance for circumferential or longitudinal stretching during installation. Provide flexible tubing exhibiting the following characteristics:
 - i. Homogeneous wall thickness.
 - ii. Contains no intermediate or encapsulated elastomeric layers.
 - iii. Contains no material that may cause delamination in the cured UV-CIPP liner.
 - iv. Have an inner foil layer or calibration hose to contain resin and be removed after completion of installation unless inner foil is a permanent part of the system and

**SECTION 33 01 30.72 – REHABILITATION BY ULTRAVIOLET LIGHT CURED-IN-PLACE
PIPE**

fabricated as an integral part of the tube by bonding or fusing.

- v. Sewn or bonded seams, as recommended by the tube manufacturer, stronger than the non-seamed material.

 - b. The tube manufacturer shall provide to the Contractor the minimum pressure required to hold the tube tight against the host pipe and the maximum allowable pressure so as not to damage the tube. Contractor shall submit the same to the Engineer at the preconstruction conference.

 - c. Unless otherwise specified, the tube shall be fabricated to a size that when installed will tightly fit the internal circumference of the original conduit to be lined. The Contractor shall be responsible for ensuring that the material is the correct circumference and length prior to ordering and installation.

 - d. Prior to insertion, the liner tube shall be free of all visible tears, holes, cuts, foreign materials, and other defects.
2. Resin:
- a. Furnish resin meeting the requirements of ASTM F2019. The installed liner system will comply with the structural and chemical resistance requirements as specified.

 - b. Provide thermosetting polyester, vinyl ester, or photo-initiator catalyst system compatible with the UV curing equipment and installation process, with the ability to cure in the presence or absence of water, and with a curing initiation temperature as recommended by the resin manufacturer. Resins created from recycled materials are not allowed.

 - c. Furnish fully impregnated liner directly from the manufacturer, including required certification documentation according to ASTM F2019. No onsite or mobile impregnation will be allowed. Resins shall be tinted for visibility and provide indication of adequate liner wet-out.

 - d. The initiation temperature for cure shall be as recommended by the resin manufacturer and approved by the Engineer. Upon request, the Contractor shall furnish satisfactory written certification that the materials comply with the manufacturer's standards and the reference specifications.

 - e. The liner shall be fabricated from materials which, when cured, will be chemically resistant to withstand exposure to normal wastewater. Resin shall form no excessive bubbling or wrinkling during lining.

 - f. The Contractor shall submit documentation from the resin manufacturer specifically describing the chemical characteristics of the resin system, including allowable mixing, impregnations, and handling time, transportation and storage time, and recommended curing cycle, pressures and times.

 - g. If remedial measures are available to extend either of the maximum allowable times indicated above, without affecting the physical properties of the resin, the resin manufacturer should describe these measures and the time limits beyond which even these measures will not prevent alteration of the physical properties of the resin.

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3. Minimum Criteria: The minimum criteria given in the specifications shall not be lowered to accommodate test values less than the required minimum.

C. Structural Requirements

1. The cured CIPP shall conform to the minimum physical properties, as listed below:

Table 1. CIPP Physical Properties

Characteristic	Test Method	Polyester Resins
Flexural Strength	ASTM D 790	6,500 psi
Flexural Modulus of Elasticity (Initial)	ASTM D 790	725,000 psi (min)

2. The newly installed pipe shall be designed for a **minimum fifty-year** continuous loading condition.
3. The liner pipe shall be designed as a stand-alone pipe capable of sustaining live and dead loads. The design of the pipe shall be based on the requirements of ASTM F2019, ASTM F1216 Appendix X1, ASTM F1743, and meet the following conditions and parameters:

Condition	Parameter
Service Life:	Greater than 50 years
Pipe condition:	Existing ductile iron pipe corroded, full penetration and full circumferential cracks, voids, deteriorated joints with internal repair bands installed.
Bury depth to top of conduit:	As indicated on the drawings (deepest invert between manholes, less nominal pipe diameter).
External water pressure:	18' above pipe crown.
Soil density:	110 lbs/cubic foot.
Trench width:	Nominal pipe diameter plus 2 feet.
Traffic load:	HS-20 highway loading.
Maximum Deflection:	5%
Cured Resin Creep:	50%
Extra thickness for resin migration:	7%.
Pipe Ovality:	2%
Modulus of Soil Reaction:	700 psi
Enhancement Factor:	7.0
Design Safety Factor:	2

- a. Calculations to determine wall thickness requirements of the liner pipe shall be submitted to the Engineer prior to construction. Design assumptions must be clearly stated. Design submittals must be signed and stamped by a registered professional engineer.

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D. Chemical Resistance

1. Chemical resistance shall be in accordance with the requirements of Section 8 of ASTM F 1216, Section X2, Chemical Resistance Tests for polyester, or vinyl ester, and completed in accordance with ASTM D 543. Exposure should be for a minimum of one month at 73.4 degrees F when subjected to the following solutions:

Chemical Solution	Concentration, %
Tap Water (ph 6-9)	100
Nitric Acid	5
Phosphorus Acid	10
Sulphuric Acid	10
Gasoline	100
Vegetable Oil	100
Detergent	0.1
Soap	0.1

- a. The Contractor shall be responsible for all costs associated with the chemical resistance tests. Proof of meeting these requirements shall be provided to the Engineer for approval at least 7 days prior to the commencement of work.

2.2 PIPE LINER END SEAL

- A. The hydrophilic end seals completely seal the liner from any annular space leakage between the liner and the host pipe. The use of caulking, rope or band type of an end seal will not be allowed. Hydrophilic end seals must be the following, or approved equal:
 1. Tubular hydrophilic sleeve, 3.5 inches in length. Product shall be Insignia End Seal by LMK Technologies or approved equal.

PART 3 - EXECUTION

3.1 PUBLIC NOTIFICATION

- A. The Contractor shall maintain service usage throughout the duration of the Project. At Outer Drive lift station, service to the adjacent National Oceanic & Atmospheric Administration (NOAA) owned property may not be interrupted for more than 4 hours. The Contractor shall contact the NOAA/Alaska Department of Fish and Game (ADF&G) Research Vessel Maintenance Shop on the adjacent property, informing them of the work to be conducted, and when their sewer service will be off-line. The Contractor shall also deliver a written notice to NOAA/ADF&G the day prior to the beginning of work, and provide a telephone number that the shop can call to discuss any problem

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which may arise. Contractor may reach the Vessel Maintenance Shop at 907-465-4144.

3.2 INSTALLATION PREPARATION

- A. Sequence of Work: The contractor shall perform the work in the following sequence.
 - 1. Determine flows and bypass pumping required
 - 2. Clean the pipeline
 - 3. Divert pipeline flow (if necessary)
 - 4. Pre-insertion internal CCTV inspection
 - 5. Removal of protrusions, debris, and cleaning (as necessary)
 - 6. Install the liner
 - 7. Post Insertion internal CCTV inspection
- B. Pre-Installation Inspection of pipelines
 - 1. The inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections using closed circuit television (CCTV) for non-man entry or manually for man entry.
 - 2. The interior of each pipeline shall be carefully inspected before installation of CIPP to determine the location of any conditions that may prevent proper installation of CIPP into pipeline.
 - a. All such conditions shall be documented and corrected before CIPP installation. Accurate in-pipe documentation measures shall be utilized to record the distance or measurement for each service line and obstruction. The manhole identification system used on the contract drawings shall be utilized in all project documentation.
 - b. The Contractor shall keep a suitable log for reference and shall record all CCTV inspections on DVD/USB drive. The Contractor shall provide the Owner with a copy of all inspection DVD/USB drives and logs.
- C. Dewatering
 - 1. The Contractor shall be responsible for protecting the work area from groundwater inflow to the extent necessary to complete the pipe lining. The Contractor shall submit a dewatering plan to the Engineer at the preconstruction conference.
 - 2. The pipeline is below typical high tide elevation and expected to become inundated during daily tide cycle.
- D. Pre-insertion Cleaning
 - 1. The Contractor shall be responsible for cleaning the existing pipeline to be lined, removing debris, mineral deposits, and loose foreign material.
 - 2. The Owner shall be present during the cleaning operation.
 - 3. The Contractor shall remove any existing lateral taps which protrude into the existing pipeline.

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Protruding taps discovered during the pre-installation inspection shall be removed by the Contractor with prior approval of the Engineer and paid under the same bid item, if applicable or per a price agreed to in advance of the work. There are no known laterals or services entering the project pipeline.

4. Contractor shall either allow the Owner and Engineer to view the CCTV inspection as it is completed or provide the Owner and Engineer with digital recorded video of the cleaned pipe to be lined for review to ensure that the pipelines have been adequately cleaned prior to CIPP installation.
 5. If the cleaning is not acceptable to the Owner or Engineer, Contractor shall reclean and re-TV the pipeline to the Owner/Engineer's satisfaction.
- E. Line Obstructions: If an obstruction in the existing pipe (such as, but not limited to heavy solids, dropped joints, or collapsed pipe) that cannot be removed by conventional pipe cleaning methods or prohibits CIPP of the main, then:
1. A point repair or an obstruction removal shall be made by the Contractor, with the prior approval of the Owner and Engineer.
 2. All point repairs or obstruction removals requiring an external dig shall be considered a separate pay item.
- F. Handling of Pipe
1. All pipe furnished by the Contractor shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe.
 2. The stacking of pipe during storage should be done according to manufacturer's recommendations.
 3. The handling of the pipe should be done in such a manner that it is not damaged by dragging over sharp objects or by lifting equipment.
- G. By-Passing Flow
1. The Contractor shall make arrangements for maintaining wastewater service when a main is being lined including by-pass pumping as required.
 2. Under no circumstances shall the dumping of raw sewage on streets or private property be allowed.
 3. Bypass pumping shall consist of base flow bypass and a redundant pump and pipe for emergency storm event bypass operations, see Section 015137 – Bypass Pumping for additional information.
 4. Contractor shall demonstrate preparations for emergency backup equipment including pumps, pipe, and generating equipment. No wastewater mains shall be blocked until such equipment is on-site.
- H. Excavation: All excavation shall conform to the CBJ Standard Specifications and Special

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Provisions to Section 02202 – “Excavation and Embankment” and Section 02203 - “Trenching”.

3.3 INSTALLATION PROCEDURES - CURED-IN-PLACE PIPE (CIPP):

- A. The method of installation shall be according to ASTM F2019 and compatible with the manufacturer's recommended practices.
- B. The Contractor shall, in his submittals, provide detailed information on the procedure and the steps to be followed for the installation of the CIPP. All such instructions and procedures shall be submitted at the preconstruction conference and shall be carefully followed.
- C. Insertion
 - 1. The Contractor shall transport and store tube in an appropriate manner until it is inserted through an existing manhole by technique/process approved by the Engineer. The transport and storage time shall comply with submittals received.
 - 2. Do not modify the existing manhole structures unless authorized by the City. If due to negligence an existing manhole (bench, barrel, chimney, grade rings, ring or cover) is damaged, the contractor shall recommend a repair method acceptable to the City and repair the manhole at no additional cost to the City. Do not put undue stress on existing structures.
 - 3. Apply constant winch tension to pull the liner into place to extend fully between the access manhole and next designated manhole or termination point. Do not exceed Manufacturer’s recommended pulling speed and tension. Should the overall elongation exceed the Manufacturer’s recommendations, the liner will be rejected and replaced at no additional cost.
 - 4. Incrementally pressurize the liner to the recommended inner pressure. Apply sufficient pressure head to hold the liner tight to the pipe wall. Maintain pressure to allow water pockets to exfiltrate through the host pipe, overcome external hydrostatic pressure, and prevent lifts in the liner. Do not allow workers in the manhole during pressurization of the liner. Properly install and attach packers and clamping straps. When constant positive pressure is specified, maintain internal pressure above the springline against the crown of the pipe from insertion to final curing without any loss of pressure.
 - 5. Individual insertion runs may be made over one or more manhole sections as determined in the field by the Contractor and approved by the Engineer. The pressure required to hold the flexible tube tight against the host pipe, per manufacturer's submittal, shall be maintained until the cure has been completed. Should the pressure deviate more than 2.3 ft. of water (1 psi) from the required minimum pressure at either end of the section, the installed tube shall be removed from the host conduit at the Contractor’s expense. The Contractor shall provide the Engineer with a continuous log of pressure during cure.
 - 6. Segments of liner that have been resin impregnated and placed in the host conduit and then are found to be too short shall be removed without curing and discarded at the Contractor’s expense. Removal of the uncured, resin impregnated liner shall be accomplished in such a way as to minimize the amount of resin allowed to escape. The Contractor shall be responsible for cleanup of all escaped resin. The Contractor shall submit a plan for the process of removing resin impregnated, uncured line from the host conduit, including protection of the host system from

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escaping resin, to the Engineer prior to the first installation process.

D. Curing:

1. Provide a UV light train that meets the following requirements:
 - a. minimum of one camera for UV-CCTV inspection of the liner,
 - b. size of the light train is appropriate for the pipe diameter,
 - c. UV bulbs are in proper proximity to the liner wall all around the pipe circumference,
 - d. sensors to record the cure progress,
 - e. logged hours of individual UV Lights incorporated in the light train is less than 80% of the manufacturer's stated usage rate
2. Maintain light train usage log on-site and submit to City's Construction Manager upon request.
3. Operate the ultraviolet curing lamps at a sufficient output and in a sufficient frequency range to ensure curing of the resin.
4. Optimize the multi-lamp ultraviolet curing lights and resin photo-initiator system for curing of the provided resin.
5. Assemble the UV light train according to the manufacturer's recommendations for the sewer pipe and liner diameter. Cure the liner according to the curing protocol, as approved. Maintain light train speed per the manufacturer's requirements, and to assure exothermic reaction has completed. Do not pull the UV light train in a downhill direction during the curing process unless otherwise approved. Approval will not be given where pipe slopes are greater than or equal to 3.0%.
6. Collect curing data and UV-CCTV inspection records during the installation and curing process. Submit copies to the City for review. Where the curing data and the curing protocol differ, the City reserves the right to require additional "in pipe" sampling and testing at no additional cost.

E. Sealing at Manholes

1. Form a tight seal between the CIPP and the manhole wall at the pipe penetration. Do not leave any annular gaps.
 - a. Seal the annular space with a hydrophilic end seal.
 - b. Seal any annular spaces greater than ½-inch with manhole wall repair material.
 - c. Finish off the seal with a non-shrink grout or cementitious liner material placed around the pipe opening from inside the manhole in a band at least 3.5 inches wide. Sealing of pipes at manholes shall be considered incidental to the liner installation and no separate payment shall be made.

F. Finished Pipe

1. The finished CIPP shall be continuous over the entire length from manhole to manhole and be free from visual defects such as foreign inclusions, dry spots, lifts, delaminations, wrinkles, pinholes, and other deformities.
2. Liner that is found to be too small or too large in circumference when curing is completed shall

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be considered a failed liner. Correction, removal, or repair of the failed liner shall be the responsibility of the Contractor at no extra cost to the Owner. Indicators include, but are not limited to, gaps between the liner and the host conduit, cracks in the line, and wrinkles/folds in the liner. Acceptable method of correction, removal, or repair shall be at the sole discretion of the Engineer and shall be approved in writing by the Engineer with prior field demonstration if required by the Engineer.

3.4 TESTING

- A. The Contractor shall collect representative sample coupons from the cured CIPP for testing as described herein. Coupons shall be taken from a representative sample for each liner diameter and thickness installed on the project. The Contractor shall stamp or mark the test pieces with the date of manufacture and manhole number. These samples shall be incidental to the price of liner installation.
- B. For each sample location, the Contractor shall provide two (2) CIPP samples in accordance with paragraphs 8.1 through 8.1.3 of ASTM F 1216.
- C. The Contractor shall provide certified laboratory test results of the following:
 - 1. The Contractor shall provide certified test results of the short-term properties of the cured lining material in the quantity of one test per liner batch, or 3,000 feet of installed liner, or as required by the Owner. The liner shall be in compliance with the physical properties described in these Specifications. Flexural strength and modulus shall be tested in accordance with the requirements of ASTM D 790. For pressure line, tensile strength and modulus of elasticity shall be tested in accordance with the requirements of ASTM D 638.
 - 2. The wall thickness will be measured in accordance with the applicable sections of ASTM Test Method D5813 and D3567.

3.5 FINAL ACCEPTANCE

- A. Visual inspection of the completed CIPP shall be in accordance with paragraph 8.7 of ASTM F 1216 and shall be done no later than one week after completion of the lining.
 - 1. The Contractor shall perform a close-circuit television inspection after installation and service line reconnection has been completed. The Contractor shall keep a suitable log for reference and shall record the final CCTV inspections on DVD/USB drives and logs. Unedited copies of the digital logs shall be provided to the Owner and Engineer to be kept for review.
 - a. The installation of the CIPP shall not be considered substantially complete until the video inspection is received and reviewed by the Engineer.
 - 2. The Contractor shall notify the Engineer of the inspection schedule not less than 48 hours prior to conducting the inspection and shall permit the Engineer to view the inspections.
 - 3. The Contractor shall use a 360-degree radial view camera for close-up views showing completed work, including the condition of restored taps.
 - 4. This work shall be considered incidental to the CIPP installation for which no separate

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payment will be made.

- B. Any defects which will affect the integrity or strength of the CIPP, in the opinion of the Owner or Engineer, shall be repaired at Contractor expense in a manner satisfactory to the Owner and Engineer.
 - 1. The finished product shall have no visual and material defects, no defects in smoothness and continuity, except where anticipated by the precondition of the existing pipe. The finished product shall be free of pinholes, folds and wrinkles.

3.6 CLEANUP

- A. After the installation has been completed and accepted, the Contractor shall clean up the entire project area and return area affected by the operation to a condition at least equal to that existing prior to the work. All excess material and debris shall be disposed of by the Contractor.

END OF SECTION

SECTION 33 01 30.74 – REHABILITATION BY THERMAL CURED-IN-PLACE PIPE

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. The work consists of furnishing all labor, equipment, materials, and incidentals required to rehabilitate existing sewer mains by the installation of cured-in-place pipe (CIPP) into the existing main. Work will include bypass pumping, pipe cleaning, closed circuit television (CCTV) inspection of pipeline to be lined, installation of liner, reconnection of service connections, if applicable, final (CCTV) inspection, traffic control, public outreach, and all other related work. All such work shall comply with these specifications and the specific product manufacturer's recommendations. Any conflict between the product manufacturer's recommendations and any portion of the contract documents shall be resolved with the Owner and Engineer prior to proceeding with the work. The location and nominal size of sewer main rehabilitation by CIPP methods are shown on the project drawings.

1.2 RELATED WORK:

- A. SECTION 02200 – Earthwork

1.3 REFERENCE STANDARDS:

ASTM D 543	Standard Test Methods for Resistance of Plastics to Chemical Reagents.
ASTM D 638	Standards Test Methods for Tensile Properties of Plastics.
ASTM D 790	Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM D 792	Standard Test Methods for Density and Specific Gravity of Plastics by displacement.
ASTM F 1216	Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
ASTM F 1743	Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe.
ASTM D 2122	Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D2990	Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.
ASTM D 5813	Cured-in-Place Thermosetting Resin Sewer Pipe.

These standards are a part hereof by such reference and shall be the latest edition and revision thereof. In the case of conflicting requirements between this specification and these referenced documents, this specification shall govern.

1.4 PRODUCT QUALIFICATIONS

- A. Products used in the work of this section shall be produced by manufacturers regularly engaged in the manufacture of cured-in-place liners for municipal wastewater and stormwater systems and with a history of successful production acceptable to the owner.
- B. Products shall meet the following criteria: A minimum of 250,000 linear feet of successful wastewater or stormwater collection system installations in the U.S. must be documented to the satisfaction of the Owner and Engineer. Additionally, a minimum of five (5) successful wastewater or stormwater collection system projects of a similar size and scope of work shall be performed in

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the U.S. and documented to the satisfaction of the Owner and Engineer to assure commercial viability.

1.5 INSTALLER QUALIFICATIONS

- A. The installer shall have at least three (3) years active experience in the commercial installation of the product bid. In addition, the installer must have successfully installed at least 50,000 feet of the product bid in wastewater or stormwater collection systems. The Contractor shall submit a complete list of installer qualifications and complete work history for the field superintendent who will be on site for the duration of the project, and the service lateral cutter, if applicable, who will perform such work for this project.

The installing Contractor shall be licensed by the cured-in-place lining system manufacturer and shall have successful experience in the installation of cured-in-place lining systems in municipal wastewater or stormwater systems. The Contractor shall also be familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. Superintendent:

1. The entire pipe lining project shall be field supervised by a project superintendent with the following lining installation and supervisory experience. This installation experience shall be with the specific liner system and type proposed: three (3) successfully completed projects within the past 1½ years amounting to at least 2,000 linear feet of 24" and larger pipe per project; and at least one year bypass pumping supervisory field experience.

1.6 QUALITY ASSURANCE

- A. The finished liner shall be continuous over the entire length of the liner insertion run between the manholes and shall be free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination.
- B. Wrinkles in the finished liner pipe which cause a backwater of one inch or more or reduce the hydraulic capacity of the pipe are unacceptable and shall be removed or repaired by the Contractor. If a void between the wrinkle and the pipe develops, the Contractor shall repair or replace that section of the pipe. Methods of repair shall be proposed by the Contractor and submitted to the owner for review. Minor internal diameter reductions in the liner where the liner passes through pipe repair bands are allowable provided a smooth transition along the pipe is ensured, and the reduction does not cause a backwater of more than one inch.
- C. Following pipeline cleaning and prior to installation of liner and finish work at the manholes, the pipeline shall be televised and recorded in digital format acceptable to the Engineer such as DVD or USB drive, and shall be provided to the Engineer. The Contractor shall also televise the pipeline after completion of all liner insertion and finish work at the manholes. All (CCTV) work is to be completed per a national standard for pipeline inspections.

1.7 SUBMITTALS

- A. After notification of award, the Contractor shall provide the following information:

1. A comprehensive construction sequencing plan. At a minimum the plan shall include the

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following (if applicable):

- a. Proposed schedule.
 - b. Identification of all proposed access routes.
 - c. Identification of set-up locations for lining installation.
 - d. Lining procedures.
 - e. Bypass pumping plan.
 - f. Dewatering plan (if dewatering is deemed necessary by the Contractor)
 - g. Traffic control plan.
 - h. Pollution control plan
2. Letter identifying the crew members performing the lining.
 3. Liner manufacturer's certification that personnel involved in installation of the pipe liner have successfully completed training in handling, jointing, insertion, trimming, reinstatement of service connections, and finishing of pipe liner.
 4. Calculations supporting recommended liner thicknesses. See 2.1.C of this specification for additional requirements.

B. Prior to initiation of the liner work, the Contractor shall submit the following information:

1. Shop drawings and product data for the rehabilitation method including a report outlining the process to be used in the rehabilitation of the pipeline(s). The report shall also include information specific to the job, such as coordination issues, access, timing, manufacturer's installation instructions and bypass pumping.
2. Infrared spectrum analysis for proposed resin and confirmation of the resins meeting ASTM D 5813.
3. Detailed description of lubricant proposed for inversion process. Lubricant shall be compatible with the Owner's wastewater treatment plant operations.
4. Certification of resin volume and required 5% to 10% addition.
5. Certification from resin manufacturer regarding styrene-free reactive monomer or epoxy resin.
6. Certification from resin manufacturer regarding approval of resin dye quantity and type.
7. Information on the maximum allowable tensile stress for the tube from the felt manufacturer.
8. The Contractor shall furnish Material Safety Data Sheets for all appropriate materials to be used in the project.

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9. All measurements made by the Contractor to verify length and diameter of pipe prior to ordering of material.

10. One complete set of DVDs/USB drive from each of the pre-installation television inspections performed.

C. Results of field quality control monitoring, laboratory testing of field samples and video inspections:

1. Curing logs showing temperature and pressure readings.

2. Results of field sample testing as specified in Section 3.04.

3. One complete set of DVDs/USB drive and log from each of the post-installation television inspections performed as specified in Section 3.05.

1.8 DELIVERY, STORAGE AND HANDLING

A. Care shall be taken in shipping, handling and storage to avoid damaging the liner. Extra care shall be taken during extreme heat or extreme cold weather construction. Any liner damaged in shipment shall be replaced as directed by the Engineer.

B. Any liner showing a split or tear, or which has received a blow that may have caused damage, even though damage may not be visible, shall be marked as rejected and removed at once from the job site.

C. The liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. Extra care shall also be taken in hot weather construction. The liner shall be protected from UV light prior to installation. Any liner showing evidence of premature curing will be rejected for use and will be removed from the site immediately.

D. Any liner that has a shelf life over six months will be rejected. All liners shall have a record with the date the material was manufactured.

1.9 WARRANTY

A. The Contractor shall provide the Owner with a warranty to be in force and effect for a period of two (2) year from the date of final acceptance of the project by the Owner. The warranty shall cause the Contractor to repair or replace the liner should failure or damage result from faulty materials or installation. At the end of the warranty period, the Owner may perform a television inspection to confirm the condition of the liner.

PART 2 - PRODUCTS

2.1 CURED-IN-PLACE PIPE (CIPP):

A. General

1. This specification provides for the rehabilitation of pipelines by the installation of Cured-in-Place Pipe (CIPP) in accordance with ASTM F 1216-16 and as modified herein. The cured-in-place pipe shall be a premium, corrosion resistant, polyester, vinyl ester, or epoxy and catalyst,

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thermosetting resin, vacuum impregnated into a flexible felt, non-woven or woven tube. The resin impregnated tube is formed to the host pipe by means of either hydrostatic head or air pressure, per ASTM F 1216-16. Curing is accomplished in accordance with the specified curing schedule supplied by the resin manufacturer or other method approved by the resin manufacturer and the Engineer. Installation of the CIPP shall be performed by a Contractor fully licensed by the lining process manufacturer.

B. Materials

1. Tube:

- a. The liner tube shall consist of one or more layers of flexible needled felt or an equivalent non-woven and/or woven material capable of carrying resin, withstanding installation pressures and curing temperatures, and compatible with the resin system used, in accordance with Section 5.1 of ASTM F 1216-16.
- b. The tube manufacturer shall provide to the Contractor the minimum pressure required to hold the tube tight against the host pipe, and the maximum allowable pressure so as not to damage the tube, and shall submit same to the Engineer at the preconstruction conference.
- c. Unless otherwise specified, the tube shall be fabricated to a size that when installed will tightly fit the internal circumference of the original conduit to be lined. The Contractor shall be responsible for ensuring that the material is the correct circumference and length prior to ordering and installation.
- d. Prior to insertion, the liner tube shall be free of all visible tears, holes, cuts, foreign materials, and other defects.

2. Resin:

- a. Furnish resin meeting the requirements of ASTM F1216, Section 5.2, or ASTM F1743, Section 5.2.3. The installed liner system will comply with the structural and chemical resistance requirements as specified.
- b. Provide thermosetting polyester, vinyl ester, or epoxy resin and a catalyst system compatible with the installation process, with the ability to cure in the presence or absence of water, and with a curing initiation temperature as recommended by the resin manufacturer. No onsite or mobile impregnation will be allowed. Resins shall be tinted for visibility and provide indication of adequate liner wet-out.
- c. The initiation temperature for cure shall be as recommended by the resin manufacturer and approved by the Engineer. Upon request, the Contractor shall furnish satisfactory written certification that the materials comply with the manufacturer's standards and the reference specifications
- d. The liner shall be fabricated from materials which, when cured, will be chemically resistant to withstand exposure to normal sewer. Resin shall not be affected by ultraviolet light and shall form no excessive bubbling or wrinkling during lining.
- e. The Contractor shall submit documentation from the resin manufacturer specifically describing the chemical characteristics of the resin system, including allowable mixing,

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impregnations, and handling time, transportation and storage time, and recommended curing cycle including temperatures, pressures and times. The resin manufacturer's documentation must also include maximum allowable time for handling the impregnated tube prior to inversion and the maximum allowable elapsed time from inversion to hardening.

- f. If remedial measures are available to extend either of the maximum allowable times indicated above, without affecting the physical properties of the resin, the resin manufacturer should describe these measures and the time limits beyond which even these measures will not prevent alteration of the physical properties of the resin.
 - g. The cured-in-place pipe shall meet the requirements of ASTM F 1216-16 when tested in accordance with ASTM F 1216-16 by an independent testing laboratory approved by the Engineer.
3. Minimum Criteria: The minimum criteria given in the specifications shall not be lowered to accommodate test values less than the required minimum.

C. Structural Requirements

- 1. The cured CIPP shall conform to the minimum physical properties, as listed below:

Table 1. CIPP Physical Properties

Characteristic	Test Method	Polyester Resins
Flexural Strength	ASTM D 790	4,500 psi
Flexural Modulus (Initial)	ASTM D 790 ASTM D 2990	250,000 psi
Flexural Modulus (Long Term)	ASTM D 2990	125,000 psi

- 2. The newly installed pipe shall be designed for a **minimum fifty-year** continuous loading condition.
- 3. The liner pipe shall be designed as a stand-alone pipe capable of sustaining live and dead loads. The design of the pipe shall be based on the following criteria unless alternate criteria are approved by the Engineer.

Condition	Parameter
Service Life:	Greater than 50 years
Pipe condition:	Existing ductile iron pipe corroded, full penetration and full circumferential cracks, voids, deteriorated joints with internal repair bands installed.
Bury depth to top of conduit:	As indicated on the drawings (deepest invert between manholes, less nominal pipe diameter).
External water pressure:	18' above pipe crown.
Soil density:	110 lbs/cubic foot.
Trench width:	Nominal pipe diameter plus 2 feet.

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Traffic load (typ):	HS-20 highway loading.
Maximum Deflection:	5%
Cured Resin Creep:	50%
Extra thickness for resin migration:	7%.
Pipe Ovality:	2%
Modulus of Soil Reaction:	700 psi
Enhancement Factor:	7.0
Design Safety Factor:	2

- a. Calculations to determine wall thickness requirements of the liner pipe shall be submitted to the Engineer prior to construction. The required structural CIPP wall thickness shall be designed in accordance with ASTM F 1216 Appendix X1. Design assumptions must be clearly stated. **Design submittals must be signed and stamped by a registered professional engineer.**

D. WET-OUT

1. The tube shall be vacuum impregnated with a resin and catalyst system and all materials and methods utilized shall be in accordance with the requirements of the particular system utilized.

E. CHEMICAL RESISTANCE

1. Chemical resistance shall be in accordance with the requirements of Section 8 of ASTM F 1216, Section X2, Chemical Resistance Tests for polyester, vinyl ester, or epoxy resins and completed in accordance with Test Method D 543. Exposure should be for a minimum of one month at 73.4 degrees F when subjected to the following solutions:

Chemical Solution	Concentration, %
Tap Water (ph 6-9)	100
Nitric Acid	5
Phosphorus Acid	10
Sulphuric Acid	10
Gasoline	100
Vegetable Oil	100
Detergent	0.1
Soap	0.1

- a. The Contractor shall be responsible for all costs associated with the chemical resistance tests. Proof of meeting these requirements shall be provided to the Engineer for approval at least 7 days prior to the commencement of work.

2.2 PIPE LINER END SEAL

- A. The hydrophilic end seals completely seal the liner from any annular space leakage between the liner and the host pipe. The use of caulking, rope or band type of an end seal will not be allowed.

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Hydrophilic end seals must be the following, or approved equal:

1. Tubular hydrophilic sleeve, 3.5 inches in length. Product shall be Insignia End Seal by LMK Technologies, or approved equal.

PART 3 - EXECUTION

3.1 PUBLIC NOTIFICATION

- 3.2 The Contractor shall maintain service usage throughout the duration of the Project. At Outer Drive lift station, service to the adjacent National Oceanic & Atmospheric Administration (NOAA) owned property may not be interrupted for more than 4 hours. The Contractor shall contact the NOAA/Alaska Department of Fish and Game (ADF&G) Research Vessel Maintenance Shop on the adjacent property, informing them of the work to be conducted, and when their sewer service will be off-line. The Contractor shall also deliver a written notice to NOAA/ADF&G the day prior to the beginning of work, and provide a telephone number that the shop can call to discuss any problem which may arise. Contractor may reach the Vessel Maintenance Shop at 907-465-4144.

3.3 INSTALLATION PREPARATION:

- A. Sequence of Work: The contractor shall perform the work in the following sequence.

1. Determine flows and bypass pumping required.
2. Clean the pipeline.
3. Divert pipeline flow (if necessary)
4. Pre-insertion internal CCTV inspection.
5. Removal of protruding taps, spot repairs and cleaning as necessary.
6. Install the liner.
7. Reinstate internal service connections.
8. Post Insertion internal CCTV inspection

- B. Pre-Installation Inspection of pipelines:

1. The inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections using closed circuit television (CCTV) for non-man entry or manually for man entry. The interior of each pipeline shall be carefully inspected before installation of CIPP to determine the location of any conditions that may prevent proper installation of CIPP into pipeline. All such conditions shall be documented and corrected before CIPP installation.
2. Accurate in-pipe documentation measures shall be utilized to record the distance or measurement for each service line and obstruction. The manhole identification system used on the contract drawings shall be utilized in all project documentation. The Contractor shall keep a suitable log for reference and shall record all CCTV inspections on DVD/USB drive. The Contractor shall provide the Owner with a copy of all inspection DVD/USB drives and logs.

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C. Dewatering:

1. The Contractor shall be responsible for protecting the work area from groundwater inflow to the extent necessary to complete the pipe lining. The Contractor shall submit a dewatering plan to the Engineer at the preconstruction conference.
2. The pipeline is below typical high tide elevation and expected to become inundated during daily tide cycle.

D. Pre-insertion Cleaning:

1. The Contractor shall be responsible for cleaning the existing pipeline to be lined, removing debris, mineral deposits, and loose foreign material. Debris shall be collected and removed downstream of the sections to be lined. **The Contractor shall take precautions to prevent damage to the existing host pipe during the cleaning process.**
2. The Owner shall be present during the cleaning operation.
3. The Contractor shall remove any existing lateral taps which protrude into the existing pipeline. Protruding taps discovered during the pre-installation inspection shall be removed by the Contractor with prior approval of the Engineer and paid under the same bid item, if applicable or per a price agreed to in advance of the work.
4. Contractor shall either allow the Owner and Engineer to view the CCTV inspection as it is completed or provide the Owner and Engineer with digital recorded video of cleaned pipe to be lined for review to ensure that the pipelines have been adequately cleaned prior to CIPP installation.
5. If the cleaning is not acceptable to the Owner or Engineer, Contractor shall reclean and re-TV the pipeline to the Owner/Engineer's satisfaction.

E. Line Obstructions: If an obstruction in the existing pipe (such as, but not limited to heavy solids, dropped joints, or collapsed pipe) that cannot be removed by conventional pipe cleaning methods or prohibits CIPP of the server main, then a point repair or an obstruction removal shall be made by the Contractor, with the prior approval of the Owner and Engineer. Protruding taps may be robotically trimmed from within the pipeline or repaired with a PVC wye and couplings or with a new watertight saddle connection. All point repairs or obstruction removals requiring an external dig shall be considered a separate pay item.

F. Handling of Pipe: All pipe furnished by the Contractor shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. The stacking of pipe during storage should be done according to manufacturer's recommendations. The handling of the pipe should be done in such a manner that it is not damaged by dragging over sharp objects or by lifting equipment.

G. By-Passing Flow:

1. The Contractor shall make arrangements for maintaining wastewater service when a main is being lined including by-pass pumping as required.
2. Under no circumstances shall the dumping of raw sewage on streets or private property

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be allowed.

3. Bypass pumping shall consist of base flow bypass and a redundant pump and pipe for emergency storm event bypass operations, see Section 015137 – Bypass Pumping for additional information.
 4. No separate payment shall be made for by-passing pumping or other measures necessary to maintain sewer service.
 5. Contractor shall demonstrate preparations for emergency backup equipment including pumps, pipe, and generating equipment. No wastewater mains shall be blocked until such equipment is on-site.
- H. Excavation: All excavation shall conform to the CBJ Standard Specifications and Special Provisions to Section 02202 – “Excavation and Embankment” and Section 02203 – “Trenching”.

3.4 INSTALLATION PROCEDURES - CURED-IN-PLACE PIPE (CIPP):

- A. The method of installation shall be compatible with the manufacturer's recommended practices.
- B. The Contractor shall, in his submittals, provide detailed information on the procedure and the steps to be followed for the installation of the CIPP. All such instructions and procedures shall be submitted at the preconstruction conference and shall be carefully followed.
- C. Wet Out: The Contractor shall designate a location where the felt tube shall be impregnated ("wetted out") with resin using distribution rollers and vacuum, to thoroughly saturate the felt tube prior to its dispatch for installation. The Contractor shall inform the Engineer a minimum of twenty-four hours in advance of each wet out process. Resin impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall.
- D. Insertion:
 1. The Contractor shall transport and store the wetted out tube in an appropriate manner until it is inserted through an existing manhole by technique/process approved by the Engineer. The transport and storage time shall comply with submittals received.
 2. The impregnated tube shall be inserted through existing or new manholes and the application of a hydrostatic head, compressed air, or other means sufficient to fully extend it to the next designated manhole.
 3. The Contractor shall ensure that the pressure in the liner exceeds both the pressure due to the groundwater head and any pressure due to flow in laterals or connecting side pipelines.
 4. A pre-liner may be installed prior to liner inversion in pipelines with infiltration or missing pipe sections.
 5. Individual insertion runs may be made over one or more manhole sections as determined in the field by the Contractor and approved by the Engineer. The pressure required to hold the flexible tube tight against the host pipe, per manufacturer's submittal, shall be maintained until the cure

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has been completed. Should the pressure deviate more than 2.3 ft. of water (1 psi) from the required minimum pressure at either end of the section, the installed tube shall be removed from the host conduit at the Contractor's expense. The Contractor shall provide the Engineer with a continuous log of pressure during cure.

6. Segments of liner that have been resin impregnated and placed in the host conduit and then are found to be too short shall be removed without curing and discarded at the Contractor's expense. Removal of the uncured, resin impregnated liner shall be accomplished in such a way as to minimize the amount of resin allowed to escape. The Contractor shall be responsible for cleanup of all escaped resin. The Contractor shall submit a plan for the process of removing resin impregnated, uncured line from the host conduit, including protection of the host system from escaping resin, to the Engineer prior to the first installation process.
- E. Curing: After insertion of the wetted out tube is complete, the Contractor shall use a hot water recirculation system or steam, capable of delivering desired heat uniformly throughout the section, for a consistent cure of the resin. The curing temperatures shall comply with submittals. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat source. Another such gauge shall be placed between the impregnated tube and the invert of the host pipe at the manhole(s) to determine the temperatures during the resin cure process. Initial cure may be considered completed when the exposed portions of the felt tube appear to be hard, and the remote sensing device(s) indicates the temperatures to be adequate, as recommended by the resin manufacturer and approved by the Engineer.
 1. The cure temperature shall be held for the period recommended by the resin manufacturer, during which time the distribution and control of the curing medium shall continue. Curing the CIPP shall consider the host pipe material, resin/catalyst system, ambient temperature, moisture level, and thermal conductivity of the soil.
- F. Cool Down: The Contractor shall cool the hardened liner to a temperature below 113 degrees F before relieving the pressure in the section. Cool-down may be accomplished by the introduction of cool water or air into the lined pipe to replace water or steam and water being drained. Water shall be drained from a small hole made in the downstream end, with all water captured unless otherwise approved by the Owner. Care shall be taken in the release of the static head or air pressure so that a vacuum will not be developed that could damage the pipe or the newly installed lining. After the tube is cured, a cool down period shall be used prior to opening the downstream plug and returning normal flow back into the system.
- G. Sealing at Manholes: Form a tight seal between the CIPP and the manhole wall at the pipe penetration. Do not leave any annular gaps. Seal the annular space with a hydrophilic end seal. Seal any annular spaces greater than 1/2-inch with manhole wall repair material. Finish off the seal with a non-shrink grout or cementitious liner material placed around the pipe opening from inside the manhole in a band at least 3.5 inches wide. Sealing of pipes at manholes shall be considered incidental to the liner installation and no separate payment shall be made.
- H. Finished Pipe: The finished CIPP shall be continuous over the entire length from manhole to manhole and be free from visual defects such as foreign inclusions, dry spots, lifts, delaminations, wrinkles, pinholes, and other deformities.
 1. Liner that is found to be too small or too large in circumference when curing is completed shall be considered a failed liner. Correction, removal, or repair of the failed liner shall be the responsibility of the Contractor at no extra cost to the Owner. Indicators include, but are not

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limited to, gaps between the liner and the host conduit, cracks in the line, and wrinkles/folds in the liner. Acceptable method of correction, removal, or repair shall be at the sole discretion of the Engineer and shall be approved in writing by the Engineer with prior field demonstration if required by the Engineer.

2. It is the intent of these specifications that branch connections be reopened without excavation, utilizing a remote-controlled cutting device, monitored by CCTV. Initially, each lateral shall be relieved by cutting a 2 to 3-inch hole to ensure that no services will be interrupted and there will be no risk of backed up lines. Once this is accomplished, each lateral shall be fully reopened to a minimum of 95% of its original size. The Contractor shall maintain on the jobsite a minimum of two (2) complete working cutters plus key spare components. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

3.5 TESTING:

- A. The Contractor shall collect representative sample coupons from the cured CIPP for testing as described herein. Coupons shall be taken from the lesser of either 15% of the manholes on the project or a representative sample for each liner diameter and thickness installed on the project. The Contractor shall stamp or mark the test pieces with the date of manufacture and manhole number. These samples shall be incidental to the price of liner installation.
- B. For each sample location, the Contractor shall provide two (2) CIPP samples in accordance with paragraphs 8.1 through 8.1.3 of ASTM F 1216.
- C. The Contractor shall provide certified laboratory test results of the following:
 1. The Contractor shall provide certified test results of the short-term properties of the cured lining material in the quantity of one test per liner batch, or 3,000 feet of installed liner, or as required by the Owner. The liner shall be in compliance with the physical properties described in these Specifications. Flexural strength and modulus shall be tested in accordance with the requirements of ASTM D 790. For pressure line, tensile strength and modulus of elasticity shall be tested in accordance with the requirements of ASTM D 638.
 2. The wall thickness will be measured in accordance with the applicable sections of ASTM Test Method D5813 and D3567.

3.6 FINAL ACCEPTANCE:

- A. The inspection shall be done no later than one week after completion of the lining. Visual inspection of the completed CIPP shall be in accordance with paragraph 8.7 of ASTM F 1216. The Contractor shall keep a suitable log for the reference and shall record the final CCTV inspections on DVD/USB drives and logs. The Contractor shall perform a close-circuit television inspection after installation and service line reconnection has been completed. The Contractor shall notify the Engineer of the inspection schedule not less than 48 hours prior to conducting the inspection and shall permit the Engineer to view the inspections. The Contractor shall use a 360-degree radial view camera for close up views showing completed work, including the condition of restored taps. Unedited DVD/USB drives and a suitable log shall be provided to the Owner and Engineer to be kept for review. The installation of the CIPP shall not be considered substantially complete until the video inspection is received and reviewed by the Engineer. This work shall be

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considered incidental to the CIPP installation for which no separate payment will be made.

- B. Any defects which will affect the integrity or strength of the CIPP, in the opinion of the Owner or Engineer, shall be repaired at Contractor expense in a manner satisfactory to the Owner and Engineer. The finished product shall have no visual and material defects, no defects in smoothness and continuity, except where anticipated by the precondition of the existing pipe. The finished product shall be free of pinholes, folds and wrinkles.

3.7 CLEANUP:

- A. After the installation has been completed and accepted, the Contractor shall clean up the entire project area and return area affected by the operation to a condition at least equal to that existing prior to the work. All excess material and debris shall be disposed of by the Contractor.

END OF SECTION

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SECTION 333220 – DRY PIT SUBMERSIBLE PUMPS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. SCOPE: The work covered by this section includes the furnishing, installation and startup testing of dry pit submersible pumps and appurtenances.
- B. Section Includes:
 - 1. Dry Pit submersible sewage pumps
 - 2. Startup, including initial testing and placing pumps into operation

1.2 RELATED SECTIONS

- A. SECTION 262419 - Low Voltage Motor Control Centers
- B. SECTION 262923 - Variable Frequency Drive Units
- C. SECTION 406100 - Process Control and Instrumentation Systems Commissioning

1.3 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.1 – Cast Iron Pipe Flanges and Flanged Fittings
- B. American Society for Testing and Material (ASTM) International
 - 1. A 48: Standard Specification for Gray Iron Castings.
 - 2. A743: Standard Specification Iron-Chromium Nickel, Corrosion Resistant
- C. Hydraulic Institute: Current Standards.
 - 1. HI 14.6: Hydrodynamic Pumps for Hydraulic Performance Acceptance Tests.
 - 2. HI 11.6: Submersible Pump Tests
- D. NEMA
- E. NFPA

1.4 SUBMITTALS

- A. Shop Drawings shall provide the layout of mechanical equipment and anchor bolt locations for pumps and other coordination dimensions. Contractor piping connections and station access clearances shall be dimensioned relative to the station centerline.
 - 1. Pump name, identification number and specification number
 - 2. Performance curve data including points on the H/Q curves, and the limits recommended for stable operation between which the pumps may be operated without surge, cavitation, and

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vibration. The stable operating range shall include multiple speed curves (VFD curves) for a range including 30-60 Hz at 5 Hz increments.

3. Detailed pump description and specification
 4. Electrical data shall be submitted in accordance with the requirements of Division 26 and 40.
 5. Assembly and installation drawings including, shaft size, seals, couplings, anchor bolt plan, part nomenclature, material list, outline dimensions, shipping and hoisting weights, pedestal mounting requirements and frame bracket mounting requirements.
- B. Spare Parts: The pump manufacturer shall include a list of suggested spare parts of all items of each pump, motor, and drive, subject to wear, such as seals, packing, gaskets, nuts, bolts, washers, wear rings and bearings.
- C. Field Procedures: Instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to installation of the pumps.
- D. Tools: Special tools necessary for maintenance and repair of the pumps and one pressure grease gun for each type of grease required for pumps and motors shall be furnished as a part of the WORK hereunder; such tools shall be suitably stored in metal toolboxes, and identified with the pump station name by means of stainless steel or solid plastic name tags attached to the box
- E. Manufacturer's Standard Recommended Start-up Report Form
- F. Factory Test:
1. Verification of the pump characteristic curves by testing at 1/4, 1/2, 3/4, and full flow and recording the measured head and motor current for each flow.
 2. Verification of cavitation-free service and absence of motor overheating during conditions simulating the actual operating conditions after installation, whether submerged or semi-submerged.
 3. Verification of the watertightness of each pump seal at a minimum submergence of 65 feet for 30 minutes.
 4. All parts shall be properly lubricated and protected so that no damage or deterioration will occur even during a prolonged delay from the time of shipment until installation is completed and the pumps are ready for operation.
 5. Finished ferrous surfaces not painted shall be properly protected to prevent rust and corrosion.
 6. The finished surfaces of all exposed flanges shall be protected by strong wooden blind flanges.
 7. Each pump shall be properly crated to protect the units against damage during shipment.

1.5 QUALITY ASSURANCE

- A. The pump manufacturer shall have overall responsibility to supply the pumping unit (submersible pump/motor, and cables) that meet the requirements of this specification. Thus, during start-up, installation, and performance evaluation, the pump manufacturer is the sole responsible party. The

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pump manufacturer shall supply a list of installations at which pumps of his/her manufacture, and ones similar to those specified, have been operating for at least 5 years.

- B. Provide the services of a competent installation engineer (including those from Contractor's suppliers) who is knowledgeable and experienced with the installation and start-up procedures for submersible pumps and the associated equipment specified. The installation engineer shall be responsible for providing complete direction during installation, initial starting, and subsequent operation of equipment until field test are completed. The installation engineer shall initiate instructions for actions necessary for proper receipt, inspection, handling, uncrating, assembly, and testing of equipment. The installation engineer shall also keep a record of measurements taken during erection and shall furnish one copy to the Owner on request or on the completion of the installation. The installation engineer shall instruct the Owner's personnel as designated in the operation and maintenance features of the pump units.

1.6 MAINTENANCE MATERIALS

- A. The pump manufacturer shall provide printed instructions relating to proper maintenance, including lubrication, and parts lists indicating the various parts by name, number, and diagram where necessary, shall be furnished in duplicate with each unit or set of identical units in each pumping station.

1.7 WARRANTY

- A. The SUPPLIER shall furnish to the OWNER the manufacturer's written guarantees, that the pumping equipment will operate with the published efficiencies, heads, and flow ranges and meet these Specifications.
- B. The SUPPLIER shall furnish a prorated manufacturer's warranty, in writing, in which the mechanical seals, impeller, pump housing, wear rings, ball bearings, and rotor and stator are guaranteed for 18 months against defects in materials and workmanship and guaranteed on a prorated basis against defects in materials and workmanship for at least 5 years or 10,000 operating hours as contained in the standard manufacturer's warranty provided by ITT Flygt.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. The pumps will be inspected for damage when received at the project site. Store the pumps and associated equipment in a covered, dry, and ventilated location prior to installation as recommended by the pump manufacturer, protected from construction or weather hazards at the project site. Proper equipment for handling the pumps shall be supplied and shall be considered as special tools if not considered standard. Follow the manufacturer's recommendations for extended storage and handling of the pumps.

PART 2 -- PRODUCTS

2.1 DRY PIT SUBMERSIBLE PUMPS

- A. Outer Drive Pump Station Wet Weather Pump: Furnish one wet weather pump to be installed dry-pit, horizontal orientation, provide mounting frame, hardware, telescopic inlet, centerline discharge flange oriented vertically.

1. Flygt NZ 3306/736 3~670

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- a. Impeller Diameter: 445 mm
 - b. Impeller Material: Hard Iron™
 - c. Curve No: 63-670
 - d. Total Moment of Inertia: 82.3 lb-ft²
 - e. Rated Speed: 1190 RPM
 - f. Performance:
 - i. Full Speed Duty Point: 4200 GPM @ 105 ft TDH
 - ii. Static Head: 43 ft
 - g. Motor:
 - i. 6 Pole
 - ii. 460V
 - iii. 60hz
 - iv. Motor Shaft Power: 175 hp
 - v. Rated Current: 214 A
 - vi. Starting Current: 1545 A
- B. Outer Drive Pump Station Dry Weather Pump: Furnish two dry weather pumps to be installed dry-pit, horizontal orientation, provide mounting frame, hardware, centerline discharge flange oriented vertically.
- 1. Flygt NZ 3202 MT 3~641
 - a. Impeller Diameter: 354 mm
 - b. Impeller Material: Hard Iron™
 - c. Curve No. (Not Used)
 - d. Total Moment of Inertia: 14.9 lb-ft²
 - e. Rated Speed: 1180 RPM
 - f. Performance:
 - i. Full Speed Duty Point: 1870 GPM @ 62 ft TDH
 - ii. Static Head: 43 ft
 - g. Motor:
 - i. 6 Pole
 - ii. 460V
 - iii. 60hz
 - iv. Motor Shaft Power: 44 hp
 - v. Rated Current: 53 A
 - vi. Starting Current (Direct): 370 A

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- C. West Juneau Pump Station Pumps: Furnish two dry weather pumps to be installed dry-pit, vertical orientation, hardware, reducing elbow inlet, centerline discharge flange oriented horizontally.

1. Flygt NT 3301 MT 3~634

- a. Impeller Diameter: 404 mm
- b. Impeller Material: Hard Iron™
- c. Curve No. (Not Used)
- d. Total Moment of Inertia: 30.2 lb-ft²
- e. Rated Speed: 1185 RPM
- f. Performance:
 - i. Full Speed Duty Point: 1860 GPM @ 95 ft TDH
 - ii. Static Head: 73 ft
- g. Motor:
 - i. 6 Pole
 - ii. 460V
 - iii. 60hz
 - iv. Motor Shaft Power: 85 hp
 - v. Rated Current: 109 A
 - vi. Starting Current (Direct): 685 A

D. Motor:

1. Contractor Submittals

- a. Furnish submittals in accordance with Division 01.
- b. Complete motor data shall be submitted. Motor data shall include:
 - i. Motor manufacturer.
 - ii. Motor type or model and dimension drawing. Include motor weight.
 - iii. Nominal horsepower.
 - iv. NEMA design.
 - v. Enclosure.
 - vi. Frame size.
 - vii. Winding insulation class and temperature rise class.
 - viii. Voltage, phase, and frequency ratings.
 - ix. Service factor.
 - x. Full load current at rated horsepower for application voltage.
 - xi. Full load speed.
 - xii. Torque characteristics.
 - xiii. Guaranteed minimum full load efficiency. Also, nominal efficiencies at 1/2 and 3/4 load.

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- xiv. Type of thermal protection or overtemperature protection, if included.
 - xv. Wiring diagram.
 - xvi. Bearing data. Include recommendation for lubricants of relubricatable type bearings.
 - xvii. Power factor at 1/2, 3/4 and full load.
2. Design Requirements
- a. General: Electric motors shall comply with NEMA MG-1 - Motor and Generator. Motors shall be premium efficiency, inverter duty, for use with variable frequency drive.
 - b. NEMA Design: Electric motors shall be NEMA Design B unless otherwise indicated. In no case shall starting torque or breakdown torque be less than the value in NEMA MG 1. Motors shall be suitable for the indicated starting method.
 - c. Insulation: Three phase motors shall be provided with Class F insulation, rated to operate at a maximum ambient temperature of 40 °C and at the altitudes where the motors will be installed and operated, without exceeding Class B temperature rise limits stated in NEMA MG 1-12.44. Motors shall be provided with insulation systems to withstand 1600-volt spikes, with dV/dt as defined in NEMA MG 1-31.
 - d. Motors shall be Totally Enclosed Fan Cooled (TEFC) with a Service Factor of 1.15, unless otherwise indicated.
 - e. The motor shall be capable of no less than 15 evenly spaced starts per hour.
 - f. The motor shall be housed in an air-filled, watertight chamber.
 - g. The motor shall be submersible, conforming to IEC standard 60034 and protection class IP 68. The motor shall operate when the station is subjected to flooding and the motor is completely submerged by a water column up to 65 feet.
3. Accessory Requirements
- a. General: Motors shall have split-type cast metal conduit boxes.
 - b. Motors shall have anti-backspin ratchet.
 - c. Lifting Devices: Motors weighing 265 lb (120 Kg) or more shall have suitable lifting eyes for installation and removal.
 - d. Grounding Lugs: Provide motor grounding lug suitable to terminate ground wire, sized as indicated.
 - e. Nameplate: Motors shall be fitted with permanent stainless-steel nameplates indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1-10.40.
- E. Pump Volutes: The pump volute shall be a single-piece, gray cast iron, non-concentric design with centerline discharge and a drain to aid with inspection and maintenance. Passages shall be smooth and large enough to pass any solids which may enter through the impeller.

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- F. Impeller: Pump impellers shall be mounted to motor shaft by means of an engineering compression collet, key and keyway or a combination of both elements. Impellers and insert ring shall be made of ASTM A-532 Alloy III A with 25% chrome. The leading edges shall be hardened to 60 HRC.
- G. Power Cable: The power cable shall be sized according to NEC standards. The outer jacket of the cable shall be oil and water-resistant chlorinated polyethylene (CPE) rubber and be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. Cable entry shall consist cylindrical elastomeric compression seals to ensure a hermetic seal between the junction chamber and the motor. Cable shall be rated for use with Variable Frequency Drives (VFDs).
- H. Pump Shaft: The pump shaft shall rotate on at least three grease-lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust. The minimum L10 bearing life of 3301 and 3302 model pumps shall be 50,000 hours at any point along the usable portion of the pump curve at maximum product speed. The L10 bearing life of 3306 model pumps shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed. The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. The sensor shall activate an alarm and shut the pump down if high temperatures occur. The bearings shall be insulated for VFD operation.
- I. Shaft Seal: The shaft seal shall be a positively driven dual, tandem mechanical shaft seal system consisting of two seals, each having an independent spring system. The seal shall be in a separate lubricant chamber and cooled and lubricated by environmentally friendly propylene glycol. The lubricant chamber shall be designed to prevent over-filling, shall provide capacity for lubricant expansion, and shall have one drain and one inspection plug.
- J. Base Assembly:
 - 1. Outer Drive:
 - a. Each pump shall have an integral 316 stainless steel suction service inlet for ease of inspection and visual verification of impeller clearance using a feeler gage. The use of spool pieces, clamping type fittings, tees, or other devices which require removal of fittings, hoists, cranes, and or lifting devices, or that potentially impart negative hydraulic impact to the pump inlet per HI standards shall not be considered acceptable. All service inlet devices shall be hydrostatically tested and integrally mounted to the pump volute for the pump working pressure. The use of pipe expansion joints to facilitate impeller gap adjustment shall not be acceptable.
 - b. Each pump motor shall be assembled on a galvanized steel service cart. The cart shall provide a rigid support and enable the removal of the rotating assembly from volute without disturbing volute or piping and without the need for hoists or lifting apparatus during impeller maintenance. The service cart for the Wet Weather Pump NZ3306/736 shall not use wheels or rollers. A service sled shall be used which provides safe extension and retraction and adequate clearance of volute to enable wear ring, impeller, and lower seal replacement. A lifting cradle shall be provided to enable safe and easy removal of pump and motor from the station for major repairs without the need for lifting slings. Service shall not require more than 1 person.
 - 2. West Juneau: The pumps shall be oriented in the dry T configuration, secured to a steel support bracket and cast concrete pump plinths of suitable strength to support the weight of the pump

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and resist the pump torsion, bending, and vibration forces. The pumps shall be supplied with Flygt T installation kit and contain a suction elbow with handhole access to the impeller. The plinth dimensions, reinforcing design, anchor bolts, grout finishing, and mounting instructions for the specified pumps shall be provided by Xylem Flygt.

K. Sensors: The motor shall be protected by the following sensors:

1. 3 bi-metal Thermal switches for thermal control of the stator
2. 1 PT 100 thermal sensor (RTD) to monitor the stator temperature of 1 Winding
3. 1 PT 100 thermal sensor (RTD) to monitor the temperature of the main bearing
4. 1 Vibration sensor to monitor vibration on 3 axes from 10 – 600 Hz
5. 1 float switch in leakage chamber to monitor leakage in the leakage chamber
6. 1 float switch in the terminal connection housing to monitor any leakage through the cables and the cable entries

2.2 SUBMERSIBLE CABLE CONNECTION BOX. NEMA 6P (INTEX, RALSTON OR SIMILAR)

- A. The submersible cable of the pump shall be connected to the power & monitoring cables in a cable connection box integral with the pump motor housing.
- B. The cable connection box shall be submersible NEMA 6P (IP 67) to secure that no water can enter the motor via the cables even when the complete station is flooded.

2.3 MOTOR PROTECTION FOR PUMP STATIONS

- A. Pump Electronic Module (PEM): The pump shall be supplied with a PEM mounted inside the motor. The PEM shall collect, store and digitize all measurement from all sensors and shall communicate the data in a digital format via 2 control leads integral to the pump power cable to a Base unit mounted in a pump control cabinet to the Central control unit. The signals from the sensors shall be digital and transferred by just 2 leads within the motor cable. An additional pilot cable shall not be allowed. The PEM shall have information about the pump as well as features for startup and service support, such as:
 1. Pump serial number and other data plate information.
 2. Specific configuration of monitoring functions for the actual pump such as alarm limits, delays, reset types, etc.
 3. Counters by which the system can generate service reminders in accordance with the service policy specified in the pump manual.
 4. Operating data and alarm history to analyze the condition of the pump and enable troubleshooting and reporting.
 5. Accumulated running time and number of starts.
 6. Pump duty rate (percentage of operation).

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2.4 MONITORING & STATUS (FLYGT MAS 801 OR EQUIVALENT)

- A. The pump manufacturer shall supply a control system designed to monitor, control and provide protection to the pumps. The Monitoring system shall be mounted in the cabinet and contain per pump 1 Base unit acting as a gateway between the Pump and the Central Monitoring and a Central Control Unit (CU). The CU shall be able to control up to 10 Pumps.
- B. Each pump shall be connected by just 2 controls leads to the base unit (BU). The control leads shall be part of the Motor cable. An additional Pilot cable shall not be allowed.
- C. The Base Unit (BU) shall be able to stop the pump if required via an interlocking relay and it shall provide connections for optional measuring modules such as a power meter and other I/O modules.
- D. The central unit (CU) shall be provided for external access and information exchange with the monitoring system via one single point. The user should be able to connect to the CU via an RJ45 jack to Local PC point to point and Local area network.
- E. A local operator panel shall be possible to connect to the CU via a separate RJ45 socket.
- F. The CU shall have a functionality based on embedded web pages that can be used through a PC or operator panel that allows:
 - 1. A graphical user interface for configuration and analysis via computer and HMI
 - 2. Pump status overview
 - 3. Alarm management
 - 4. Analysis through trend graphs and histograms.
 - 5. External communication with any SCADA via Modbus RTU or Modbus TCP
- G. The CU shall contain the same pump data and logged data stored in each pump electronic module for quick access and redundancy.
- H. The system shall support the service and maintenance policy that applies to the pump by generating service reminders and graphically providing users with an overview of service status that facilitates planning of upcoming service.
- I. The MCC Cabinet shall be equipped with HMI Touch panel for access and interaction with the Monitoring and Control system. The panel should be at least 15 inches in size and able to show color.
- J. When a pump related alarm is generated, the system shall support the user in the form of:
 - 1. Measurement data linked to the specific alarm item for analysis.
 - 2. Text information about possible root cause errors.
 - 3. Remedial actions.

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PART 4 -- EXECUTION

4.1 INSPECTION

- A. Examine conditions under which materials and equipment are to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

4.2 INSTALLATION

- A. Install pumps as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.
- B. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up. A step-by-step sequence shall be outlined in the field test plan prior to start-up.

4.3 FIELD QUALITY CONTROL

- A. All pumping units shall be field tested after installation, in accordance with the Contract Documents, to demonstrate satisfactory operation, without causing excessive noise, vibration, cavitation, and overheating of the bearings.
- B. A field test plan shall be submitted by an experienced field test engineer prior to field testing. The following items, at a minimum, shall be included for checking on the field-testing plan:
 1. Stator and power cables
 2. Seal lubrication
 3. Proper rotation
 4. Power supply voltage
 5. Measure motor operating load and no-load current
 6. Measure motor power factor and efficiency at full operating load
 7. Measure motor voltage and current on each phase
 8. Check level control operation and sequence
- C. The field testing shall be performed in the presence of an experienced field representative of the Pump Manufacturer of each major item of equipment, who shall supervise the following tasks and shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation:
 1. Ensure all construction debris and foreign material has been removed from the wet well. Contractor shall supply an adequate volume of clear water to operate station through several pumping cycles.
 2. Start-up, check, and operate the equipment under normal operating conditions.
 3. Pump performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, pump suction head, pump discharge head and pump flow. Each power lead to the motor shall be checked for proper current balance.

SECTION 333220 – DRY PIT SUBMERSIBLE PUMPS

4. Electrical and instrumentation testing shall conform to the requirements of Division 26 – Electrical and Division 40 – Process Interconnections.
5. The field testing shall be witnessed by the OWNER or its representative. In the event any of the pumping equipment fails to meet the above test requirements, it shall be modified and retested in accordance with the requirements of these Specifications.

END OF SECTION

SECTION 333220 – DRY PIT SUBMERSIBLE PUMPS

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SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 THE REQUIREMENT

- A. Provide the piping systems indicated, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section shall apply to piping sections in Divisions 40.
- C. The process Drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type.
- D. The mechanical Drawings are not pipe construction or fabrication drawings.
- E. Where pipe supports and spacing are indicated on the Drawings and are referenced to a Standard Detail, the CONTRACTOR shall use that Detail.
- F. Where pipe supports are not indicated on the Drawings, it is the CONTRACTOR'S responsibility to develop the details necessary to design and construct mechanical piping systems to accommodate the specific equipment provided, and to provide spacers, adapters, and connectors for a complete and functional system.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01300 – Contractor Submittals.
- B. Shop Drawings: Shop Drawings shall contain the following information:
 - 1. Drawings: Layout drawings including necessary dimensions, details, pipe joints, fittings, specials, bolts and nuts, gaskets, valves, appurtenances, anchors, guides, and material lists. Fabrication drawings shall indicate spacers, adapters, connectors, fittings, and pipe supports to accommodate the equipment and valves in a complete and functional system.
 - 2. Thermoplastic Pipe Joints: Submit solvent cement manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.
 - 3. Gasket Material: Submit gasket manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.
 - 4. Modular Seals for Pipe: Manufacturer's catalog sheet showing materials and installation procedures.
- C. Samples
 - 1. Performing and paying for sampling and testing as necessary for certifications are the CONTRACTOR'S responsibility.
- D. Certifications

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

1. Necessary certificates, test reports, and affidavits of compliance shall be obtained by the CONTRACTOR.
2. A certification from the pipe fabricator that each pipe will be manufactured subject to the fabricator's or a recognized Quality Control Program. An outline of the program shall be submitted to the ENGINEER for review prior to the manufacture of any pipe.

1.4 MATERIAL DELIVERY, STORAGE, AND PROTECTION

- A. The CONTRACTOR shall be responsible for all such material furnished by him and shall replace, at his own expense, all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for the replacement of installed material discovered defective prior to the final acceptance of the Work or during the guarantee period.
- B. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact.
- C. Defective or damaged materials shall be replaced with new materials.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Extent of Work
 1. Pipes, fittings, and appurtenances shall be provided in accordance with the requirements of the applicable Sections of Division 40 and as indicated.
- B. Pipe Supports
 1. Pipes shall be adequately supported, restrained, and anchored in accordance with Section 400507 – Hangars and Supports for Process Piping, and as indicated.
- C. Lining
 1. Application, thickness, and curing of pipe lining shall be in accordance with the applicable Sections of 330130.
- D. Coating
 1. Application, thickness, and curing of coating on buried pipe shall be in accordance with the applicable Sections of 099700 - Special Coatings, unless otherwise indicated.
 2. Pipes above ground or in structures shall be coated in accordance with Section 099700 – Special Coatings.
- E. Pressure Rating
 1. Piping systems shall be designed for the maximum expected pressure as defined in Section 400505 – Exposed Piping Installation, or as indicated on the Piping Schedule, whichever is greater.

F. Inspection

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

1. Pipe shall be subject to inspection at the place of manufacture.
2. During the manufacture, the ENGINEER shall be given access to areas where manufacturing is in progress and shall be permitted to make inspections necessary to confirm compliance with requirements.

G. Tests

1. Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards.
2. Welds shall be tested as indicated.
3. The CONTRACTOR shall be responsible for performing material tests.

H. Welding Requirements

1. Qualification of welding procedures used to fabricate pipe shall be in accordance with the provisions of AWS D1.1 - Structural Welding Code or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.
2. Welding procedures shall be submitted for the ENGINEER's review.

I. Welder Qualifications

1. Welding shall be performed by skilled welders and welding operators who have adequate experience in the methods and materials to be used.
2. Welders shall be qualified under the provisions of AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.
3. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.
4. Qualification testing of welders and materials used during testing is part of the WORK.

2.2 PIPE FLANGES

A. General

1. Flanges shall be provided with flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated.
2. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207.

B. Flange faces shall be perpendicular to the axis of the adjoining pipe.

C. Flanges for miscellaneous small diameter pipes shall be in accordance with the standards indicated for these pipes.

D. Pressure Ratings

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

1. 150 psig or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, 150 lb class.
2. 150 psig to 275 psig: Flanges shall conform to either AWWA C207 Class E or Class F, or ASME B16.5 150 lb class.
3. 275 psig to 700 psig: Flanges shall conform to ASME B16.5, 300 lb class.
4. Selection Based on Test Pressure
 - a. Do not expose AWWA flanges to test pressures greater than 125 percent of rated capacity.
 - b. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.

E. Blind Flanges

1. Provide blind flanges in accordance with AWWA C207, or as indicated for miscellaneous small pipes.
2. Blind flanges for pipe sizes 12-inches and greater shall be provided with lifting eyes in the form of welded or screwed eye bolts.

F. Flange Coating

1. Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

G. Flange Bolts

1. Bolts and nuts shall conform to the requirements of ASTM A193 Class 2, Stainless Steel Bolts and Nuts. Use all-thread studs on valve flange connections where space restrictions preclude the use of regular bolts.

H. Insulating Flanges

1. Insulated flanges shall be provided with bolt holes 1/4-inch diameter greater than the bolt diameter.

I. Insulating Flange Sets

1. Insulating flange sets shall be furnished on all piping connections where two dissimilar metals are to be connected in order to prevent corrosion. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers, and a steel washer.
2. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inch or smaller and shall be made of acetal resin.
3. For bolt diameters larger than 1-1/2 inches, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic material.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

4. Steel washers shall be in conformance with ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
5. Insulating gaskets shall be full-face.

J. Insulating Flange Manufacturer, or Equal

1. JM Red Devil, Type E
2. Maloney Pipeline Products Co.
3. PSI Products, Inc.

K. Flange Gaskets

1. Gaskets for flanged joints used in general water and wastewater service shall be full-faced type, with material and thickness in accordance with AWWA C207, suitable for a pH of 1 to 11, and pressures to 1000 psig.
2. Blind flanges shall be provided with gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange.
3. Ring gaskets will not be accepted unless otherwise indicated.
4. Flange gaskets shall be NSF 61 Certified, Garlock, Style 3505; or equal.
5. Gaskets for flanged joints used in water with chloramines shall be Gylon, Style 3505 as manufactured by Garlock or equal.
6. Gaskets for flanges for PVC and CPVC piping used in general water and wastewater service shall be full-faced, 1/8-inch thick, and made of ethylene propylene rubber (EPR) having a Type A durometer hardness of 50 to 70 when tested in accordance with ASTM D 2240.
7. When the mating flange has a raised face, provide a flat ring gasket filler between the PVC flange and gasket and the adjacent flange.
8. Gaskets for flanged joints used in chemicals, air, solvents, hydrocarbons, steam, chlorine and other fluids shall be made of materials compatible with the service, pressure, and temperature.

2.3 THREADED INSULATING CONNECTIONS

A. General

1. Threaded insulating bushings, unions, or couplings, as appropriate, shall be furnished for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials

1. Threaded insulating connections shall be constructed of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. General

1. Grooved type couplings shall not be used for buried service. Mechanical joints or flanged fittings only shall be used.
2. Provide cast mechanical-type couplings where indicated, conforming to the requirements of AWWA C606 - Grooved and Shouldered Joints.
3. Bolts and nuts shall conform to the requirements of ASTM A193 Class 2, Stainless Steel Bolts and Nuts. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations.
4. The wall thickness of grooved piping shall conform to the coupling manufacturer's recommendations to suit the highest expected pressure.
5. In order to avoid excessive load on equipment caused by pipe movement due to steady state or transient pressure conditions, equipment connections with mechanical-type couplings shall be provided with rigid grooved couplings or flexible type coupling with harness in sizes where rigid type couplings are not available, unless thrust restraint is provided by other means.
6. Mechanical type couplings shall be bonded.
7. The CONTRACTOR shall have the coupling manufacturer's service representative verify the correct choice and application of couplings and gaskets, and the workmanship, to assure a correct installation.
8. In order to assure uniform and compatible piping components, grooved fittings, couplings, and valves shall be furnished by the same manufacturer as the coupling.
9. Grooving tools shall be from the same manufacturer as the grooved components.

B. Steel Pipe Couplings Manufacturer, or Equal

1. Gustin-Bacon (Aeroquip Corp.) (banded or grooved)
2. Victaulic Style 41 or 44 (banded, flexible)
3. Victaulic Style 77 (grooved, flexible or rigid)
4. Victaulic Style 07 or HP-70 (grooved, rigid)

C. Ductile Iron Pipe Couplings Manufacturer, or Equal

1. Gustin-Bacon, (Aeroquip Corp.)
2. Victaulic Style 31 (flexible or rigid grooving)

Note: Ductile iron pipe couplings shall be provided with flush seal gaskets.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

2.5 SLEEVE-TYPE COUPLINGS

A. General

1. Provide sleeve-type couplings where indicated.
2. The CONTRACTOR will not be allowed to substitute a sleeve-split coupling, or any other type in lieu of sleeve coupling unless approved by the ENGINEER.

B. Construction

1. Sleeve couplings shall be in accordance with AWWA C219 - Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe.
2. Couplings shall be constructed of steel with steel bolts, without pipe stop.
3. Couplings shall be of sizes to fit the indicated pipe and fittings.
4. The middle ring shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected.
5. If the strength of the middle ring material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe.
6. The coupling shall be either 5 or 7 inches long for sizes up to and including 30-inch and 10 inches long for sizes greater than 30-inch, for standard steel couplings, and 16 inches long for long-sleeve couplings.
7. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings, and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling.
8. The shape of the follower shall be of such design as to provide positive confinement of the gasket.
9. Bolts and nuts shall be in accordance with the requirements of ASTM A193 Class 2, Stainless Steel Bolts and Nuts. Buried sleeve-type couplings shall be epoxy-coated at the factory as indicated.

C. Pipe Preparation

1. Where indicated, prepare the ends of the pipe for flexible steel couplings.
2. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with an outside diameter not more than 1/64 inch smaller than the nominal outside diameter of the pipe.
3. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, in order to proof-test the weld to the strength of the parent metal.
4. The weld of the middle ring shall be subjected to air test for porosity.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

D. Gaskets

1. Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.
2. Gaskets for wastewater and sewerage applications shall be composed of Buna N, Grade 60, or equivalent suitable elastomer.
3. The rubber in the gasket shall meet the following specifications:
 - a. Color: jet black
 - b. Surface: non-blooming
 - c. Durometer Hardness: 74, plus and minus 5
 - d. Tensile Strength: 1000 psi minimum
 - e. Elongation: 175 percent minimum
4. The gaskets shall be immune to attack by impurities normally found in water or wastewater.
5. Gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Products in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as indicated above.
6. Where sleeve couplings are used in water containing chloramine or other fluids which attack rubber materials, gasket material shall be compatible with the piping service and fluid utilized.
7. Gasket materials used in water with chloramines shall be: Gylon Style 3505 by Garlock; or equal.

E. Piping Connection to Equipment

1. Where piping connects to mechanical equipment such as pumps, compressors, and blowers, bring the piping to the equipment connection aligned and perpendicular to the axis of the flange or fitting for which the piping is to be connected.
2. The piping shall not impose excessive stress to the equipment connection to cause misalignment of the equipment.
3. The CONTRACTOR shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the ENGINEER for review.

F. Insulating Sleeve Couplings

1. Where insulating couplings are required, both ends of the coupling shall be provided with a wedge-shaped gasket which assembles over a sleeve of an insulating compound material compatible with the fluid service in order to obtain insulation of coupling metal parts from the pipe.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

G. Restrained Joints

1. Sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means.
2. Harnesses shall be designed by the pipe manufacturer in accordance with AWWA Manual M11, or as indicated.
3. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.
4. Where harness sets are installed near the suction and discharge of the pump, harness bolts shall have zero elongation in order to prevent misalignment of the pump imparted by the thrust within the piping system.

H. Sleeve-Type Couplings Manufacturer, or Equal

1. Dresser, Style 38
2. Ford Meter Box Co., Inc., Style FC1 or FC3
3. Smith-Blair, Style 411

2.6 FLANGED COUPLING ADAPTERS

- A. Provide flanged coupling adapters where indicated.
- B. The CONTRACTOR will not be allowed to substitute any other type in lieu of flange coupling adapter unless approved by the ENGINEER.
- C. The coupling shall be rated as indicated.
- D. Construction
 1. Flanged coupling adapter bodies shall be fabricated from steel, ASTM A 512 - Cold-Drawn Butt-weld Carbon Steel Mechanical Tubing or A 513 - Electric-Resistance Welded Carbon and Alloy Steel Mechanical Tubing with steel bolts, without pipe stop.
 2. Provide flanges in conformance with AWWA C207.
 3. Couplings shall be of sizes to fit the indicated pipe and fittings.
 4. The body shall be not less than 1/4 inch thick or at least the same wall thickness as the pipe to which the coupling is connected.
 5. If the strength of the body material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe.
 6. The follower flange shall be fabricated from steel, ASTM A 576 - Steel Bars, Carbon, Hot Wrought, Special Quality or AISI C1012.
 7. The shape of the follower shall be of such design as to provide positive confinement of the gasket.

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8. Restraint

- a. For flanged coupling adapters installed in piping system rated for positive pressure, the coupling shall be restrained with harness bolts or tie rods.
 - b. Other means of restraining the coupling such as set screws will not be accepted.
9. Bolts and nuts shall be in accordance with the requirements of ASTM A193 Class 2, Stainless Steel Bolts and Nuts. Buried couplings shall be epoxy-coated at the factory as indicated.
10. Buried couplings shall be epoxy-coated at the factory as indicated.

E. Gaskets

1. Gaskets for flange coupling adapters shall be composed of a rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.
2. Gaskets for wastewater and sewerage applications shall be composed of Buna N, Grade 60, NSF-approved, or equivalent suitable elastomer.
3. The rubber in the gasket shall meet the following specifications:
 - a. Color: jet black
 - b. Surface: non-blooming
 - c. Durometer Hardness: 74, plus and minus 5
 - d. Tensile Strength: 1000 psi minimum
 - e. Elongation: 175 percent minimum
4. The gaskets shall be immune to attack by impurities normally found in water or wastewater.
5. Gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Products in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as noted above.
6. Where flanged coupling adapters are used in water containing chloramine or other fluids which attack rubber materials, the gasket material shall be compatible with the piping service and fluid utilized.
7. Gasket materials used in water with chloramines shall be Gylon Style 3505 by Garlock; or equal.

F. Piping Connections to Equipment

1. Where piping connects to mechanical equipment such as pumps, compressors, and blowers, bring the piping to the equipment connection aligned and perpendicular to the axis of the flange or fitting for which the piping is to be connected.
2. The piping shall not impose excessive stress to the equipment connection to cause misalignment of the equipment.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

3. The CONTRACTOR shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the ENGINEER for review.

G. Restrained Joints

1. Flange coupling adapters on pressure lines shall be harnessed unless thrust restraint is provided by other means.
2. Harnesses shall be designed by the pipe manufacturer in accordance with AWWA Manual M11, or as indicated.
3. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.
4. Where harness sets are installed near the suction and discharge of the pump, harness bolts shall have zero elongation in order to prevent misalignment of the pump imparted by the thrust within the piping system.

H. Flanged Couplings Adapter Manufacturer, or Equal

1. Smith-Blair, Model 975
2. JCM, Model 309

2.7 FLEXIBLE CONNECTORS

A. Low-Temperature

1. Flexible connectors shall be installed in piping connections to engines, blowers, compressors, and other vibrating equipment, and where indicated.
2. Flexible connectors for service temperatures up to 180 degrees F shall be flanged-reinforced neoprene or butyl spools, rated for a working pressure of 40 to 150 psig, or reinforced flanged duck and rubber, as best suited for the application.
3. Flexible connectors for service temperatures above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for a minimum 150-psig working pressure, unless otherwise indicated.
4. The connectors shall be a minimum of 9 inches long and provided with face-to-face flanges, unless otherwise indicated.
5. The final material selection shall be approved by the manufacturer.
6. The CONTRACTOR shall submit Shop Drawings and calculations.

B. High-Temperature

1. Install flexible connectors in engine exhaust piping and where indicated.
2. Connectors shall be sufficient to compensate for thermal expansion and contraction and to isolate vibration between the engine and the exhaust piping system.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

3. Connectors shall be stainless steel bellows-type, flanged, and rated for minimum 150 psig, 2000 degrees F.

2.8 EXPANSION JOINTS

- A. Piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement without exertion of undue forces to equipment or structures, accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints.
- B. Expansion joints shall be provided with flanged ends and constructed of stainless steel, Monel, rubber, or other materials best suited for each individual service.
- C. Rubber shall be FDA food grade EDPM on the inside and outside.
- D. Submit detailed calculations and manufacturer's Shop Drawings of proposed expansion joints, piping layouts, and anchors and guides, including information on materials, temperature, and pressure ratings.
- E. Indoor, Exposed Expansion Joint Manufacturer, or Equal
 1. Metraflex, Metrasphere, MSODPN, Style O
 2. Proco style 242L QQ Expansion Joint
 3. Proco style 234L QQ Expansion Joint with backup ring flange.

2.9 PIPE THREADS

- A. Pipe threads shall be in conformance with ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

2.10 PIPE INSULATION

- A. Not Used.

2.11 MODULAR MECHANICAL SEALS FOR PIPING PENETRATIONS

- A. Where indicated and where required in order to prevent flow of water or air, the passages of piping through wall sleeves and cored openings shall be sealed with modular interlocking link mechanical closures.
- B. Individual links shall be constructed of Nitrile rubber, be suitable for temperatures between minus 40 and plus 210 degrees F, and be shaped to fill the annular space between the outside of the pipe and the inside of the wall sleeve or cored opening.
- C. Assemble the links using Type 316 stainless steel bolts and nuts to form a continuous rubber belt around the pipe.
- D. Pressure plates under each bolt and nut shall be fabricated of a corrosion-resistant composite material.
- E. After the seal assembly is positioned in the sleeve, tighten the bolts against the pressure plates to expand the rubber links and form the watertight seal.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

F. Sizing and installation of sleeves and assemblies shall be in accordance with the manufacturer's recommendations.

G. Modular Mechanical Seals Manufacturer, or Equal

1. Garlock, Model OS-316 Link-Seal

2.12 HEAT TRACING

A. Not used.

2.13 AIR AND GAS TRAPS

A. Air and gas pipes shall slope to low points and shall be provided with drip legs, shut-off valves, strainers, and traps.

B. Pipe the traps to the nearest drain.

C. Air and gas traps shall be not less than 150-lb iron body float-type, with a copper or stainless steel float.

D. Bracket, lever, and pins shall be constructed of stainless steel.

E. Drain traps shall be provided with threaded connections.

F. Air and Gas Traps Manufacturer, or Equal

1. Armstrong International, Inc.

2. Spirax Sarco, Inc.

2.14 PIPELINE MARKING TAPE

A. Metallic tape shall be a minimum 5.0 mils thick, electrically conductive metallic foil imprinted on one side, encased in high visibility inert polyethylene jacket. Tape shall be manufactured to permit full view of the conductive material to verify continuity.

B. Tape shall be 12-inches wide. Imprinted lettering shall be 4-inch tall, permanent black, and shall read "CHEMICAL/WATER PIPELINES BURIED BELOW". Background color shall be selected by the OWNER.

C. Tape shall be as manufactured by Reef Industries (SentryLine), or equal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Install piping, fittings, and appurtenances in accordance with the requirements of applicable Sections of Division 33 and Division 40.

B. Proprietary manufactured couplings shall be installed in accordance with the coupling manufacturer's recommendation.

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

- C. Care shall be taken to ensure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are properly installed as follows:
1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection.
 2. Each gasket shall be centered properly on the contact surfaces.
 3. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected.
 4. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.
 5. Flange Bolts
 - a. Flange bolts shall be initially hand-tightened with the piping connections properly aligned.
 - b. Bolts shall be tightened with a torque wrench in a staggered sequence to the AISC-recommended torque for the bolt material.
 6. Harness, Thrust Restraint, and Tie Rod Bolts
 - a. Harness, thrust restraint, and tie rod bolts used for sleeve couplings, flange coupling adapters, or flexible joints shall be tightened gradually and equally at diametrically opposite sides until snug, in order to prevent misalignment and to insure that all studs carry equal loads.
 - b. In order to prevent induced stress or misalignment, do not over-torque connections to adjoining pump or equipment.
 7. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove.
 8. After installation, joints shall meet the indicated leakage rate.
 9. Flanges shall not be deformed nor cracked.
- D. Lined Piping Systems
1. The lining manufacturer shall take full responsibility for the complete, final product and its application.
 2. Pipe ends and joints of lined pipes at screwed flanges shall be epoxy-coated in order to assure continuous protection.
- E. Core Drilling
1. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction in order to avoid damage to embedded raceways and reinforcing bars.
- F. Cleanup

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

1. After completion of the WORK, cuttings, joining and wrapping materials, and other scattered debris shall be removed from the Site.
2. The entire piping system shall be handed over in a clean and functional condition.

3.2 MARKING TAPE INSTALLATION

- A. Install marking tape above all buried nonmetallic pipe, including all secondary containment pipe, a distance of 18-inches to 24-inches above the pipe unless otherwise noted on the Drawings. Tape shall be centered over the pipe and shall run continuously along the pipe in the pipe trench.

END OF SECTION

SECTION 400500 – COMMON WORK RESULTS FOR PIPING, GENERAL

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SECTION 400505 – EXPOSED PIPING INSTALLATION

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to install and test all exposed piping, fittings, and specials. The Work includes the following:
1. All types and sizes of exposed piping, except where exposed piping installations are specified under other Sections.
 2. Unless otherwise shown or specified, this Section includes all piping beginning at the outside face of structures or structure foundations and extending into the structure. Piping embedded in concrete within a structure or foundation shall be considered as exposed and is included herein. Piping that is permanently or intermittently submerged, or installed in sub-aqueous environments, is considered as exposed and is included in this Section.
 3. Work on or affecting existing exposed piping.
 4. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all Work required for a complete exposed piping installation.
 5. Supports, restraints, and other anchors.
 6. Field quality control, including testing.
 7. Cleaning and disinfecting.
 8. Incorporation of valves, meters, and special items shown or specified into the piping systems per the Contract Documents and as required
- B. Coordination:
1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before exposed piping Work.
 2. Coordinate with appropriate piping Sections of Division 40, Process Interconnections.

1.2 REFERENCES

- A. Standards referenced in this Section are:
1. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings
 2. ASME Boiler and Pressure Vessel Code.
 3. ASME B31.3, Process Piping.
 4. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Nondestructive Testing.

SECTION 400505 – EXPOSED PIPING INSTALLATION

5. ASTM A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless-Steel Parts, Equipment, and Systems
6. ASTM B32, Specification for Solder Metal.
7. ASTM D4161, Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
8. ASTM D4174, Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems
9. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
10. AWS D1.1/D1.1M, Structural Welding Code-Steel.
11. ANSI/AWWA 0111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
12. ANSI/AWWA C206, Field Welding of Steel Water Pipe.
13. ANSI/AWWA C600, Installation of Ductile Iron Water Mains and Their Appurtenances.
14. ANSI/AWWA C606, Grooved and Shouldered Joints.
15. ANSI/AWWA C651, Disinfecting Water Mains.
16. AWWA M9, Concrete Pressure Pipe.
17. AWWA M11, Steel Pipe - A Guide for Design and Installation.
18. AWWA M23, PVC Piping - Design and Installation.
19. AWWA M41, Ductile-Iron Pipe and Fittings.
20. AWWA M45, Fiberglass Pipe Design.
21. AWWA M55, PE Pipe - Design and Installation.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements and recommendations of authorities having jurisdiction over the Work.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Detailed drawings in plan and, as applicable, section.

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- b. Details of piping, valves, supports, accessories, specials, joints, harnessing, and main anchor supports, and connections to existing piping, structures, equipment, and appurtenances.
2. Testing Plans, Procedures, and Testing Limitations
 - a. Submit description of proposed testing methods, procedures, and apparatus, and obtain ENGINEER's approval prior to testing.
 3. Informational Submittals: Submit the following:
 - a. Certificates:
 - i. Submit a certificate, signed by manufacturer of each product, certifying that product complies with applicable referenced standards.
 - ii. Welder's certificate in compliance with Paragraph 3.1.E.7.c of this Section.
- B. Closeout Submittals: Submit the following:
1. Record Documentation:
 - a. Maintain accurate and up-to-date record documents showing field and Shop Drawing modifications. Record documents for exposed piping Work shall show actual location of all piping and appurtenances on a copy of the Drawings, unless otherwise approved by ENGINEER.
 - b. Record documents shall show piping with elevations referenced to the project datum and dimensions from permanent structures. For straight runs of pipe provide offset dimensions as required to document pipe location.
 - c. Include section drawings with exposed piping record documents when the Contract Documents include section Drawings.
- ### 1.5 DELIVERY, STORAGE AND HANDLING
- A. Delivery:
1. Deliver products to Site to ensure uninterrupted progress of the Work.
 2. Upon delivery, inspect pipe and appurtenances for cracked, gouged, chipped, dented, and other damage and immediately remove damaged products from Site.
- B. Storage:
1. Store products for convenient access for inspection and identification. Store products off the ground using pallets, platforms, or other supports. Protect packaged products from corrosion and deterioration.
 2. Pipe and fittings other than thermoplastic materials may be stored outdoors without cover. Thermoplastic pipe and fittings stored outdoors shall be covered.
- C. Handling:

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1. Handle pipe, fittings, specials, and accessories carefully with approved handling devices. Do not drop or roll material of delivery vehicles. Do not otherwise drop, roll, or skid piping.
2. Avoid unnecessary handling of pipe.
3. Keep pipe interiors free of dirt and foreign matter.
4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage. Repair damaged coatings.

PART 2 -- PRODUCTS

MATERIALS

- A. Piping materials are specified in the Exposed Piping Schedule at the end of this Section. Piping materials shall conform to Specification for each type of pipe and piping appurtenances in applicable sections of Division 40, Process Interconnections.
- B. Markings and Identification:
 1. Pipe Markings:
 - a. Clearly mark each piece of pipe or fitting with a designation conforming to that shown on the approved Shop Drawings.
 - b. Manufacturer shall cast or paint on each length of pipe and each fitting the pipe material, diameter, and pressure or thickness class.

PART 3 -- EXECUTION

3.1 INSPECTION

- A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

B. INSTALLATION

1. General:
 2. Install piping as shown, specified and as recommended by the pipe and fittings manufacturer.
 3. If there is a conflict between manufacturer's recommendations and the Contract Documents, request in writing instructions from ENGINEER before proceeding.
 4. Provide pipe manufacturer's installation specialist at Site as specified on this Section.
- C. Temporary Blind Flanges, Plugs, Caps, and Bulkheads:
 1. Temporarily plug installed pipe at the end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.

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2. Install standard plugs in all bells at dead ends, tees, and crosses. Cap all spigot and plain ends.
 3. Fully secure and block blind flanges, plugs, caps, and bulkheads installed for testing, designed to withstand specified test pressure.
 4. Where plugging is required for phasing of Work or subsequent connection of piping, install watertight, permanent type blind flanges, plugs, caps, or bulkhead acceptable to ENGINEER.
- D. Piping Installation:
1. Conform to manufacturer's instructions and requirements of standards and manuals listed in this Section, as applicable:
 - a. Ductile Iron Pipe: ANSI/AWWA 0600, AWWA M41.
 - b. Steel Pipe: ASME B31.3, ANSI/AWWA C206, AWWA M11.
 - c. Thermoplastic Pipe: AWWA M23
 2. Install straight runs true to line and elevation.
 3. Install vertical pipe truly plumb in all directions.
 4. Install piping parallel or perpendicular to walls of structures. Piping at angles and 45 degree runs across corners of structures will not be accepted unless specifically shown on the Contract Documents or approved by the ENGINEER.
 5. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, and other obstructions.
 6. Install piping to leave all corridors, walkways, work areas, and similar spaces unobstructed. Unless otherwise approved by ENGINEER provide a minimum headroom clearance under piping and pipe supports of 7.5 feet. Clearances beneath piping shall be measured from the outermost edge of piping, flanges or other type of joint that extends beyond the nominal outside diameter of piping.
 7. Protect and keep clean interiors, fittings, and valves of pipe that will convey potable water, chemicals, and other pipe designated by ENGINEER.
 8. Cutting: Limit field cutting of pipe. If required, cut pipe from measurements verified at Site. Field cut pipe, only where required, with a machine specially designed for cutting type of pipe being installed. Make cuts carefully without damage to pipe, coating, or lining, and with a smooth end at right angles to axis of pipe. Cut ends of push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.
- E. Jointing Pipe:
1. General:
 - a. Make joints in accordance with pipe manufacturer's recommendations and Contract Documents.
 - b. Cut piping accurately and squarely and install without forcing or springing.

SECTION 400505 – EXPOSED PIPING INSTALLATION

- c. Ream out pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.
 - d. Remove all cuttings and foreign matter from inside of pipe and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.
2. Ductile Iron Mechanical Joint Pipe:
- a. Wipe clean the socket, plain end and adjacent areas immediately before making joint. Make certain that cut ends are tapered and sharp edges are filed off smooth.
 - b. Lubricate plain end and gasket with soapy water or pipe manufacturer's recommended pipe lubricant, per ANSI/AWWA C111, just prior to slipping gasket onto plain end of joint assembly.
 - c. Place gland on plain end with lip extension toward plain end, followed by gasket with narrow edge of gasket toward the plain end.
 - d. Insert pipe into socket and press gasket firmly and evenly into gasket recess. Keep joint straight during assembly.
 - e. Push gland toward socket and center it around pipe with the gland lip against the gasket.
 - f. Insert bolts and hand tighten nuts.
 - g. Deflect joint only after assembled when approved by ENGINEER.
 - h. Make deflection after joint assembly, if approved by ENGINEER, but prior to tightening bolts. Alternately tighten bolts 180 degrees apart to seat the gasket evenly. Bolt torque shall be:

Pipe Diameter (inches)	Bolt Diameter (inches)	Range of Torque (ft-lbs)
3	5/8	45 to 60
4 to 24	3/4	75 to 90
30 to 36	1	100 to 120
42 to 48	1.25	120 to 150

3. Ductile Iron Push-On Joint Pipe:
- a. Prior to assembling joints, thoroughly clean with a wire brush the last eight inches of exterior surface of spigot and interior surface of bell, except where joints are lined or coated with a protective lining or coating.
 - b. Wipe clean rubber gaskets and flex gaskets until resilient. Conform to manufacturer's instructions for procedures to ensure gasket resiliency when assembling joints in cold temperatures.
 - c. Insert gasket into joint recess and smooth out entire circumference of gasket to remove bulges and to prevent interference with proper entry of spigot of entering pipe.

SECTION 400505 – EXPOSED PIPING INSTALLATION

- d. Immediately prior to joint assembly, apply a thin film of pipe manufacturer's recommended lubricant to surface of gasket that will come in contact with entering spigot end of pipe, or apply a thin film of lubricant to outside of spigot of entering pipe.
 - e. For assembly, center spigot in pipe bell and push pipe forward until spigot just makes contact with the rubber gasket. After gasket is compressed and before pipe is pushed or pulled in the rest of the way, carefully check gasket for proper position around the full circumference of joint. Final assembly shall be made by forcing spigot end of entering pipe past gasket until spigot makes contact with the base of the bell. When more than a reasonable amount of force is required to assemble the joint, remove spigot end of pipe to verify proper positioning of gasket. Do not use gaskets that have been scored or otherwise damaged.
 - f. Maintain an adequate supply of gaskets and joint lubricant at Site when pipe jointing is in progress.
4. Ductile Iron and Steel Flanged Joints:
- a. Assemble flanged joints using ring-type gaskets, with thickness as recommended by pipe manufacturer but not less than 1/8-inch thick, for raised-face flanges. Use full-face gaskets for flat-face flanges, unless otherwise approved by ENGINEER or recommended by pipe manufacturer. Gaskets shall be suitable for the service intended in accordance with the manufacturer's ratings and instructions. Gaskets shall be properly centered.
 - b. Tighten bolts in a sequence that provides equal distribution of bolt loads.
 - c. Length of bolts shall be uniform. Bolts shall not project beyond the nut more than 1/4-inch or fall short of the nut when fully taken up. Machine-cut ends of bolts to be neatly rounded. Do not use washers.
 - d. Prior to assembly of flanged joints, lubricate bolt threads and gasket faces.
 - e. Alternately tighten bolts 180 degrees apart to compress the gasket evenly.
 - f. After assembly, coat all bolts and nuts, except stainless steel bolts and nuts, with same coating specified in 09 97 00 Special Coatings.
- F. Installing Valves and Accessories:
1. Provide supports for large valves, flow meters, and other heavy items as shown or required to prevent strain on adjoining piping.
- G. Unions:
1. Install dielectric unions as specified in Section 40 05 06, Couplings, Adapters, and Specials for Process Piping, where dissimilar metals are connected, except for bronze or brass valves in ferrous piping.
 2. Provide a union downstream of each valve with screwed connections.
 3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.
- H. Transitions from One Type of Pipe to Another:

SECTION 400505 – EXPOSED PIPING INSTALLATION

1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

I. Closures:

1. Provide closure pieces, such as blind flanges and caps, shown or required to complete the Work.

3.2 THRUST RESTRAINT

A. General

1. Provide thrust restraint on all pressure piping systems and where otherwise shown or specified.
2. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Exposed Piping Schedule at end of this Section.

B. Restrained Pipe Joints:

1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
2. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with a proprietary restrained joint system as specified in Section 40 05 19. Ductile iron pipe, lugs, and tie rods, or other joint restraint systems approved by ENGINEER. Restrain ductile iron pipe connected by flexible couplings or flanged coupling adapters by harnessing across the coupling or adapter using tie rods or extended bolts connecting between flanges.
3. Steel Pipe Joints: Provide butt-welded joints, lap welded joints, flanged joints, or mechanical coupling connections as shown. Provide tie rods connected to lugs welded to the steel pipe for restraint at mechanical couplings.
4. Thermoplastic, FRP and HDPE Joints: Where bell and spigot-type or other non-restrained joints are utilized, provide tie rods across the joint or other suitable joint restraint system, subject to approval of ENGINEER.

3.3 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown on Drawings is approximate.
2. Determine the true location of existing piping to which connections are to be made, crossed, and that could be disturbed, and determine location of other facilities that could be affected by the Work.

B. Work on Existing Pipelines:

1. Cut or tap pipes as shown or required with machines and tools specifically designed for cutting or tapping pipelines.
2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.

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3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.

3.4 PAINTING

- A. Field painting shall conform to Section 09 97 00 Special Coatings.

3.5 FIELD QUALITY CONTROL

- A. Testing, General:

1. Test all piping, except as exempted in the Exposed Piping Schedule.
2. Notification: Notify ENGINEER at least 48 hours prior to testing.
3. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.
4. Conduct all tests in presence of ENGINEER.
5. Remove or protect pipeline-mounted devices that could be damaged by testing.
6. Provide all apparatus and services required for testing, including:
7. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.
8. Temporary bulkheads, bracing, blocking, and thrust restraints.
9. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
10. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into the pipe being tested. CONTRACTOR shall provide fluid for other types of testing required.
11. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.
12. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of ENGINEER or OWNER. Repair of existing piping will be paid as extra work unless otherwise specified.
13. Test Schedule:
 - a. Refer to the Exposed Piping Schedule for type of test required and required test pressure.
 - b. Unless otherwise specified, the required test pressures are at lowest elevation of pipeline segment being tested.
 - c. For piping not listed in Exposed Piping Schedule:

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- i. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires a separate test.
- d. Test Pressure:
 - i. Use test pressures listed in Exposed Piping Schedule.
 - ii. If test pressure is not listed in Exposed Piping Schedule, or if a test is required for piping not listed in the Exposed Piping Schedule, test pressure will be determined by the ENGINEER based on the maximum anticipated sustained operating pressure and the methods described in the applicable ANSI/AWWA manual or standard that applies to the piping system.
- B. Hydrostatic Testing:
 1. Pipeline 30-inches diameter and larger shall be visually inspected that all debris has been removed prior to flushing.
 2. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate. The CONTRACTOR shall test pipelines in sections. Sections to be tested shall be defined by isolation valves in the pipeline. Where such valves are not present, the CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing. Sections that have a zero leakage allowance may be tested as a unit.
 3. No section of the pipeline shall be tested until field-placed concrete or mortar has attained an age of 14 Days. The test shall be made by closing valves when available or by placing bulkheads and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure.
 4. The CONTRACTOR shall provide sufficient temporary tappings in the pipelines to allow for trapped air to exit. After completion of the tests, such taps shall be permanently plugged. Care shall be taken that air relief valves are open during filling.
 5. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. The air within the pipeline shall be allowed to escape completely. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the ENGINEER shall be taken.
 6. Timed test period shall not begin until after the pipe has been filled, exposed to the required wetting period, air has been expelled, and pressure stabilized.
 7. The hydrostatic test shall consist of holding the indicated test pressure on the pipeline segment for a period of 2 hours. The test pressure for yard piping shall be as indicated on the Piping

SECTION 400505 – EXPOSED PIPING INSTALLATION

Schedule measured at the lowest point of the pipeline section being tested. No pressure test will be required for a reservoir or tank overflow line. Visible leaks that appear during testing shall be repaired in a manner acceptable to the ENGINEER. Add water to restore the test pressure if the pressure decreases 5 psi below test pressure during the test period.

8. Pump from a test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at fifteen minute intervals for duration of test.
9. The maximum allowable leakage shall be as indicated on the Piping Schedule and the table below. Pipe with welded or soldered joints shall have no leakage. Exposed piping shall show no visible leaks and no pressure loss during the test. In the case of pipelines that fail to pass the leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.
10. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of the test pressure during timed test period. Allowable leakage rates for piping are:

Pipe Test Parameters

Pipe and Joint Type (See Note 3)	Test Standard	Test Pressure	Test Duration	Allowed Leakage
Ductile iron, all joint types	AWWA C600 AWWA Manual M41	150 percent of working pressure; See Note 1	2 hours	See Equation A
PVC	AWWA C605	125 percent of working pressure	2 hours	See Equation A
Welded Steel Pipe	AWWA Manual M11	125 percent of working pressure	2 hours min.	Zero

Note 1: 150 percent of working pressure, but also satisfy these conditions:

- no less pressure than 125 percent of working pressure at the highest point in the test reach
- do not exceed any pipe, fitting, or thrust restraint design pressure no more pressure than 200 percent of rated pressure of metal seated valves or hydrants
- no more than rated pressure of resilient seated gate or butterfly valves
- pressure during test must not vary more than 5 psi

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Equation A: $L = (SD/148,000)P^{1/2}$

Where:

- L = leakage, gallons per hour
- S = length tested or maximum test length allowed, whichever is smaller, feet
- D = pipe diameter, inches
- P = test pressure, psi

11. When testing against closed, metal-seated valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size is allowed.
12. Rates based on formula or table in AWWA Manual M41:
 - a. Metal and fiberglass pipe joined with rubber gaskets as sealing members, including the following joint types:
 - i. Bell and spigot and push-on joints.
 - ii. Mechanical joints.
 - iii. Bolted sleeve type couplings.
 - iv. Grooved and shouldered couplings.

C. Examination of Welds:

1. Personnel performing examination of welds shall be qualified to at least Level II, in accordance with ASNT SNT-TC-1A.
2. Conform to ASME Boiler and Pressure Vessel Code Section V and applicable articles for examination of welds.
3. Visually examine all welds, Category D Fluid Service, in conformance with ASME 831.3.
4. Examine at least ten percent of welds using liquid penetrant examination.
5. If a defect is detected, all welds shall be examined by liquid penetrant examination.
6. At conclusion of liquid penetrant examination, remove penetrant test materials by flushing, washing, or wiping clean with applicable solvents.

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3.7 CLEANING AND DISINFECTION

A. General: Clean pipe systems as follows:

1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in a manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.
2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.
3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with a five percent hypochlorite solution.

3.8 EXPOSED PIPING SCHEDULE

A. The schedules listed below, following the "End of Section" designation, are a part of this Specification section.

1. Table 40 05 05-A, Exposed Piping Schedule

TABLE 40 05 05-A EXPOSED PIPING SCHEDULE

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/ Thickness	Joint	Test
RW	4, 6, 8, 10, 12, 16, 18, 20	DI	CL	P	Class 53	FLG, GSEC, PE	HYD (100)

B. Service Abbreviations

Service	Abbrev.	Service	Abbrev.
Drain	D		
Raw Wastewater	RW		
Utility Water (non-pot)	UW		
Basin Drain	BD		

C. Material Abbreviations

Material	Abbrev.	Material	Abbrev.
Ductile Iron	DI	Polyvinyl Chloride	PVC
Cast Iron	CI	Chlorinated Polyvinyl Chloride	CPVC
Carbon Steel	CS	Polyethylene	PE
Stainless Steel	SS	High Density Polyethylene	HDPE
Copper	C	Fiberglass Reinforced Plastic	FRP

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Prestressed Concrete Cylinder Pipe	PCCP	Unlined	UL
Non-Prestressed Concrete Cylinder Pipe	CCP	Steel Cylinder Pipe	SCP

D. Lining/Coating Abbreviations

Lining	Abbrev	Coating	Abbrev.
Cement Mortar Lined	CL	Painted	P
Glass Lined	GL	Plastic Lined	PL
Ceramic Epoxy	CE	Insulated	I
Fusion Bonded Epoxy Lined	FBEL	Galvanized	Galv

E. Joint Abbreviations

Joint Type	Abbrev	Joint Type	Abbrev.
Bell and Spigot	BS	Flanged	Flg
Restrained Bell and Spigot	RBS	Butt Weld	BW
Push-on Joint	POJ	Lap Weld	LW
Restrained Push-on Joint	RPOJ	Butt Fusion Weld	BFW
Mechanical Joint	MJ	Solvent Weld	SW
Restrained Mech. Joint	RMJ	Sleeve-type Flexible Coupling	SLFC
Soldered	Sd	Split Flexible Coupling	SPFC
Brazed	Bz	Plasticized PVC Coupling	PPVC
Threaded	Thd	Grooved or Shouldered End Coupling	GSEC
		Flanged Adapter	FA

F. Test Abbreviations

Test	Abbrev	Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ()	Disinfection and Bacteriological Testing	DBT
Process Air Pipe Test (test pressure in psig)	PA ()	Examination of Welds	EW
Chlorine Pipe Test	CL	Exfiltration Test	EX
		No Test Required	NR

END OF SECTION

SECTION 400506 – COUPLINGS, ADAPTERS AND SPECIALS FOR PROCESS PIPING

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all couplings, adapters, and specials for process piping.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before couplings, adapters, and specials for process piping Work.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
2. ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-dipped, Zinc-Coated, Welded and Seamless.
3. AWWA C606, Grooved and Shouldered Joints.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer shall have at least five years' experience producing substantial similar products to those specified and shall be able to provide documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:

1. Obtain each type of coupling, adapter, and special for process piping product included in this Section, regardless of component manufacturer, from a single couplings, adapters, and specials manufacturer.
2. Supplier shall prepare, or review, and approve all submittals for components furnished under this Section.
3. Components shall be suitable for specified service conditions and be integrated into overall assembly by the Supplier.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

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- a. Submit piping layout Shop Drawings in accordance with Section 400505, Exposed Piping Installation.
2. Product Data:
 - a. Submit product data on each type of coupling, expansion joint, and other piping specialties and accessories, including gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.
- B. Informational Submittals: Submit the following:
 1. Certificates:
 - a. When requested by ENGINEER submit certificate attesting to compliance with standards referenced in this Section, signed by manufacturer.
 2. Manufacturer's Instructions:
 - a. Provide instructions for handling, storing, installing, and adjusting of products.
 3. Source Quality Control:
 - a. When requested by ENGINEER, submit results of source quality control tests.
 4. Qualifications Statements:
 - a. Submit qualifications of manufacturer when requested by ENGINEER.

PART 2 -- PRODUCTS

2.1 COUPLINGS

- A. Split-type Grooved or Shouldered End Couplings:
 1. Pressure and Service: Same as connected piping. Use shouldered end where required by pressure rating.
 2. Products and Manufacturers:
 - a. For coupling of cast-iron or ductile iron pipe, provide products of one of the following:
 - i. Style 31, as manufactured by Victaulic Company.
 - ii. Gruvlok, as manufactured by Grinnell Mechanical Products, division of Tyco.
 - iii. Or equal.
 3. For coupling of standard steel pipe, where joint deflection is desired or allowed, provide products of one of the following:
 - a. Style 77, as manufactured by Victaulic Company.
 - b. Or equal.

SECTION 400506 – COUPLINGS, ADAPTERS AND SPECIALS FOR PROCESS PIPING

4. For coupling of standard steel pipe, where joint deflection is not desired or allowed, provide products of one of the following:
 - a. Style HP-70, as manufactured by Victaulic Company.
 - b. Or equal.
 5. For coupling of stainless steel pipe, provide products of one of the following:
 - a. Style 77-S, as manufactured by Victaulic Company.
 - b. Or equal.
 6. Couplings shall conform to applicable requirements of AWWA C606.
 7. Housing Material:
 - a. For coupling of cast-iron pipe, ductile iron pipe, steel pipe, and thermoplastic pipe: Malleable iron or ductile iron.
 - b. For coupling of stainless steel pipe: Type 304 stainless steel, or equal.
 8. Gaskets:
 - a. “Flush Seal” (Victaulic), or equal. Halogenated Butyl, specially formulated to conform to ductile pipe surfaces.
 - b. Grade “E” EPDM for steel pipe.
 9. Bolts and Nuts: Heat-treated carbon steel track bolts, plated. For buried or submerged applications, provide stainless steel bolts complete with washers, Type 316 and with stainless nuts.
 10. Coating: Except for stainless steel couplings, provide orange enamel finish.
- B. Flanged Coupling Adapters (Flange by Sleeve):
1. Description: One end of adapter shall be flanged and opposite end shall have sleeve-type flexible coupling.
 2. Products and Manufacturers: Provide one of the following:
 - a. Style 911, by Smith Blair, Inc.
 - b. EBAA Iron Series 2100 MegaFlange
 - c. Or equal.
 3. Pressure and Service: Same as connected piping.
 4. Material: Ductile iron.
 5. Gasket: Recommended by the manufacturer.

SECTION 400506 – COUPLINGS, ADAPTERS AND SPECIALS FOR PROCESS PIPING

6. Bolts and Nuts: Heat-treated carbon steel track bolts, plated. For buried or submerged applications, provide stainless steel bolts complete with washers, Type 316 and with stainless nuts.
 7. Coating: Except for stainless steel couplings, provide orange enamel finish.
- C. Flanged Coupling Adapter (Flange by Groove)
1. Description: One end of adapter shall be flanged and opposite end shall have groove type coupling.
 2. Products and Manufacturers: Provide one of the following:
 - a. Style VicFlange 341
 - b. Gruvlok Fig 7012
 - c. Approved equal.
 3. Pressure and Service: Same as connected piping.
 4. Material: Ductile iron.
 5. Gasket: “Flush Seal” (Victaulic); or equal.
 6. Coating: Except for stainless steel couplings, provide orange enamel finish.
- D. Expansion Joints:
1. Description: rubber connectors used to compensate for thermal expansion or to eliminate the transmission of vibration and noise through the piping system.
 2. Products:
 - a. Single spherical rubber connector shall be of the molded type and shall be NBR with nylon cord construction
 - b. Rubber connector shall be manufactured with internal steel wire, molded within raised face ends
 - c. Flanges shall be one-piece, free-floating, 150 lb drilling galvanized plate steel type with tapped or drilled holes
 - d. Control rods shall be provided.
 3. Execution:
 - a. Rubber joints shall be installed per manufacturer’s instructions and in accordance to Rubber joints FSA’s “Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors.”
 - b. When used as expansion joints, spherical rubber joints shall be anchored and guided in accordance with EJMA recommendations.

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E. Sleeve-type, Flexible Couplings:

1. Pressure and Service: Same as connected piping.
2. Products and Manufacturers: Provide products of one of the following:
 - a. Style 253, as manufactured by Dresser Piping Specialties, part of Dresser, Inc.
 - b. Style 441, by Smith Blair, Inc.
 - c. Or equal.
3. Material: Ductile Iron.
4. Gaskets: Suitable for specified service, as recommended by manufacturer.
5. Bolts and Nuts: Alloy steel, corrosion-resistant, primer-coated. For buried or submerged applications, provide stainless steel bolts complete with washers complying with ASTM F593, AISI Type 316 and with nitrided stainless nuts.

PART 3 -- EXECUTION

3.1 INSPECTION

- A. Inspect materials for defects in material and workmanship. Verify compatibility of products with pipe, fittings, valves, and appurtenances.

3.2 INSTALLATION

- B. Install piping specialties in accordance with the Contract Documents and manufacturer's instructions.

END OF SECTION

SECTION 400506 – COUPLINGS, ADAPTERS AND SPECIALS FOR PROCESS PIPING

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SECTION 400507 – HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. SCOPE: The work covered by this section includes furnishing and installation of pipe and equipment hangers, supports, and accessories necessary to complete the work.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Manufacturer's Standardization Society (MSS) SP-58 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation

1.3 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Detailed drawings showing all hangers and supports for each piping system specified.
 - 2. Product Data:
 - a. Submit manufacturers' catalogs, literature, and engineering data on all hangers and supports.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Piping systems and pipe connections to equipment shall be properly anchored and supported in order to prevent undue deflection, vibration, and dislocation due to seismic events, line pressures, pipe weight, fluid weight, liquid movement, thermal changes, vibration, probable forces applied during construction, and stresses on piping, equipment, and structures.
- B. Standard and fabricated hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and other accessories.

2.2 SUPPORT LOCATIONS

- A. Where locations are not specifically identified in the drawings, pipe supports shall be placed according to the following guidelines.
 - 1. Generally, run piping in groups where practicable and parallel to building wall. Provide minimum clearance of 1-inch between pipe and other work.
 - 2. Install hangers or supports at all locations where pipe changes direction.
 - 3. All hangers and supports shall be capable of vertical adjustment after placement of piping.
 - 4. Different types of hangers or supports shall be kept to a minimum.
 - 5. All suspended or supported ductile iron pipe shall have a hanger or support adjacent to each hub.

SECTION 400507 – HANGERS AND SUPPORTS FOR PROCESS PIPING

- 6. Support vertical piping at each floor and between floors by stays or braces to prevent rattling and vibration.
- 7. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.

2.3 SUPPORT SPACING

- A. Maximum support spacing unless otherwise shown or approved

Pipe Size (inches)	Maximum Pipe Span ¹ (feet)			
	Steel	Copper	Plastic ²	Cast/Ductile Iron
3/8 to 3/4	5	6	Cont. ³	-
1	6	6	5	-
1-1/4	6	6	5	-
1-1/2	6	6	5	-
2	10	10	5	-
2-1/2	10	10	5	-
3	10	10	5	12 feet for pressure pipe
4	12	12	5	
6	12	12	5	
8	12	12	5	
10	12	-	5	
12	12	-	10	
14	12	-	-	
16	12	-	-	10 feet for soil pipe
18	12	-	-	
20	12	-	-	
24 and larger	12	-	-	

¹Pipe shall not have pockets formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.

²Span shown is for Schedule 80 CPVC pipe at 100°F. Spans for other plastics, other CPVC pipe Schedules and pipes at higher temperatures shall be shortened in accordance with the pipe manufacturer's recommendations.

³Continuous means pipe shall be in unistrut or similar channel.

2.4 CONCRETE ANCHORS

- A. Unless otherwise indicated, concrete anchors for pipe supports shall be according to the following table; consult the ENGINEER for any anchor applications not appearing on the table.

Pipe Support Application	Type of Concrete Anchor
--------------------------	-------------------------

SECTION 400507 – HANGERS AND SUPPORTS FOR PROCESS PIPING

New Concrete	Use embedded concrete insert anchors on a grid pattern. Use Grinnell (Anvil International), Tolco, or equal.
Existing Concrete	Use non-shrink grouted anchors, metallic type expansion anchors, or epoxy anchors. Exceptions: Metallic type expansion anchors and epoxy anchors are not permitted for pipe supports subject to vibrating loads. Epoxy anchors are not permitted where the concrete temperature is in excess of 100 deg F or higher than the limiting temperature recommended by the manufacturer. Epoxy anchors are not accepted where anchors are subject to vibration or fire.
Vibratory Loads and High-Temperature Conditions	Use non-shrink grouted anchors

2.5 HANGERS AND SUPPORTS

- A. Hangers and supports where shown shall be in accordance with detail drawings.
- B. Hangers and supports not shown shall be in accordance with MSS SP 58.
- C. Manufacturers
 - 1. Anvil International
 - 2. TOLCO
 - 3. Pipe Support Group (Bergen)
 - 4. Unistrut Corporation
 - 5. Or equal

2.6 THREADED STEEL RODS:

- A. Two-inch vertical adjustment with two nuts each end for positioning and locking.
- B. Size hanger rods according to the schedule below, unless otherwise noted:

Nominal Pipe (Inches)	Rod Diameter (Inches)
2 and less	3/8

SECTION 400507 – HANGERS AND SUPPORTS FOR PROCESS PIPING

2-1/2 to 3-1/2	1/2
4	5/8
6	3/4
8 through 12	7/8
14 through 18	1
20 through 30	1-1/4

2.7 COATING

A. Galvanizing

1. Unless otherwise indicated, fabricated pipe supports other than stainless steel or non-ferrous supports shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

PART 3 – PRODUCTS

3.1 INSTALLATION

A. General

1. Pipe supports, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions.
2. Concrete inserts for pipe hangers and supports shall be coordinated with the formwork.

B. Appearance

1. Pipe supports and hangers shall be positioned in order to produce an orderly, neat piping system.
2. Hanger rods shall be vertical, without offsets.
3. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, and without interference with other WORK.

C. Fabrication

1. Quality Control

- a. Pipe hangers and supports shall be fabricated and installed by experienced welders and fitters, using the best welding procedures available.
- b. Fabricated supports shall be neat in appearance without sharp corners, burrs, or edges.

SECTION 400507 – HANGERS AND SUPPORTS FOR PROCESS PIPING

END OF SECTION

SECTION 400507 – HANGERS AND SUPPORTS FOR PROCESS PIPING

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SECTION 400509 – WALL PIPES, FLOOR PIPES AND PIPE SLEEVES

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. SCOPE: The work covered by this section includes furnishing and installation of wall pipes, floor supports, pipe sleeves and associated appurtenances.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

AWWA C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast for Water
AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances

PART 2 -- PRODUCTS

2.1 GENERAL

2.2 WALL AND FLOOR PIPES

- A. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise approved by ENGINEER.
- B. End Connections: As shown.
- C. Thickness: Same as specified for the piping connected to wall or floor pipe.
- D. Collars: Provide collars at mid-point of wall for anchorage and watertightness.

2.3 WALL PENETRATIONS:

- A. Pipe penetrations through concrete walls without wall pipes shall be cast with pipe penetration sleeves molded from non-conductive, high impact resistant HDPE. Pipes shall be sealed within the sleeve with Link Seal modular seals. The seal shall provide a watertight penetration. Use wall penetration sleeves as provided by Century-Line and modular Link Seal system as manufactured by Garlock/ PSI / Thunderline / Link-Seal®.

2.4 CAST WALL SLEEVES:

- A. Material: Ductile iron furnished with integral wall collar.
- B. Dimensions: As required for mechanical joint pipe to pass through sleeve.
- C. Length as required.
- D. Where required, use tapped/threaded flange bolt holes for connection of all thread.

SECTION 400509 – WALL PIPES, FLOOR PIPES AND PIPE SLEEVES

PART 3 -- EXECUTION

3.1 GENERAL

A. INSTALLATION

1. Wall and Floor Pipes: Install as shown and in accordance with approved Shop Drawings.
2. Pipe Sleeves:
 - a. Use sleeves wherever pipes pass through walls, partitions, floors, and roofs, unless otherwise shown.
 - b. Extend all sleeves through floor slabs a minimum of 2-inches above finished floor.
 - c. Anchor sleeves to concrete and masonry walls as shown or otherwise approved.
 - d. All sleeves through walls shall be flush with wall face.
 - e. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.
 - f. Use link type seals to seal sleeve against hydrostatic pressure. Size sleeves to provide annular space required to suit the link type mechanical seals that are used.
 - g. Do not install sleeves and pipes through structural members, unless specifically shown and approved by ENGINEER.
 - h. Size sleeves to provide annular space as follows:

<u>Pipe Size</u>	<u>Sleeve ID Minus Pipe Or Insulation OD</u>
Less than 2-inches	1/2-inches to 3/4-inches
2-inches to 4-inches	3/4 inches to 1-1/4-inches.
6-inches to 12-inches	1-1/4 inches to 2-inches
Over 12-inches	2-inches to 3-inches

3. Install wall and ceiling plates in accordance with the manufacturer's recommendations and approved Shop Drawings.

END OF SECTION

SECTION 400519 – DUCTILE IRON PROCESS PIPE AND FITTINGS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. SCOPE: The work covered by this section includes furnishing of ductile iron pipe, fittings and appurtenances.

1.2 RELATED SECTIONS (NOT USED)

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

AWWA C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in for Water
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C116	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast for Water
AWWA C153	Ductile-Iron Compact Fittings. for Water Service
AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances
AWWA C606	Grooved and Shouldered Joints
ASTM C 150	Portland Cement

PART 2 -- PRODUCTS

2.1 PIPE GENERAL

- A. Markings: The CONTRACTOR shall legibly mark specials 24-inches diameter and larger in accordance with the laying schedule and marking diagram. Each fitting shall be marked at each end with top field centerline.
- B. Handling and Storage: The pipe shall be handled as a minimum at the 1/3 points by use of wide slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment that might injure the pipe coating/exterior will not be permitted. Stockpiled pipe shall be supported on padded skids, sand or earth berms free of rock exceeding 3-inches diameter, sand bags, or suitable means so that the coating will not be damaged. The pipe shall not be rolled and shall be secured to prevent accidental rolling

SECTION 400519 – DUCTILE IRON PROCESS PIPE AND FITTINGS

- C. Laying Lengths: Nominal pipe laying lengths shall be 20-feet.
- D. Finish: The pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing, and roughness.
- E. Closures and Correction Pieces: Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing on the Drawings. The locations of correction pieces and closure assemblies are indicated. Any change in location or number of said items shall only be as accepted by the ENGINEER.

SPECIALS AND FITTINGS

- A. Fittings for ductile iron pipe shall conform to the requirements of AWWA C153 or AWWA C110 and shall have a minimum pressure rating of 250 psi. Ductile iron fittings larger than 48-inches shall conform to AWWA C153.

2.2 DUCTILE IRON PIPE, JOINTS AND FITTINGS

- A. The pipe shall be designed, manufactured, tested, inspected, and marked according to AWWA
- B. Flanged Pipe: Fabricate in accordance with ANSI/AWWA C115.
- C. Non-Flanged Pipe: Conform to ANSI/AWWA C151 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.
- D. Exposed Piping Installation. If not otherwise specified, use Special Thickness Class 53 for three-inch to 54-inch diameter.
- E. Pipe Joints:
 - 1. Flanged Joints: Conform to ANSI/AWWA 0110 and ANSI/AWWA C111 capable of meeting the pressure rating or special thickness class, and test pressure specified in
 - a. Gaskets: Unless otherwise specified, gaskets shall be at least 1/8-inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for the service conditions specified, specifically designed for use with ductile iron pipe and fittings.
 - b. Bolts: Comply with ANSI B18.2.1.
 - i. Exposed: ASTM A307, Grade B.
 - ii. Buried or Submerged: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.
 - c. Nuts: Comply with ANSI B18.2.2.
 - i. Exposed: ASTM A563, Grade A, Heavy hex.
 - ii. Buried or Submerged: ASTM A194, Grade B8M, Heavy hex, Type 316 stainless steel.
 - 2. Grooved End Joints: Comply with ANSI/AWWA C606.

SECTION 400519 – DUCTILE IRON PROCESS PIPE AND FITTINGS

- a. Gaskets: Flush seal type designed for ductile iron that complies with or exceeds requirements of ASTM D2000
- b. See Section 4000506 Couplings, Adapters, and Specials for Process Piping

2.3 CEMENT-MORTAR LINING

- A. Cement-Mortar Lining for Shop Application: Except as otherwise provided herein, interior surfaces of ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with AWWA C104. During the lining operation and thereafter, the pipe shall be maintained in a round condition by suitable bracing or strutting. The lining machines shall be of a type that has been used successfully for similar work. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found defective at the Site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications.
 - 1. Cement: Cement for mortar lining shall conform to the requirements of AWWA C104; provided, that cement for mortar lining shall be Type II or V. Cement shall not originate from kilns that burn metal-rich hazardous waste fuel, nor shall a fly ash or pozzolan be used as a cement replacement.

The minimum lining thickness shall be as follows:

Nominal Pipe Diameter, inches	Minimum Lining Thickness, inches
3 - 12	1/16
14 - 24	3/32
30 - 64	1/8

- B. Protection of Pipe Lining/Interior: Shop-applied cement mortar lining shall be given a seal coat of asphaltic material in conformance with AWWA C104.

2.4 EXTERIOR PROTECTION OF PIPE

- A. Exterior Coating of Exposed Piping: The exterior surfaces of pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer conforming to the requirements of Section 099700 – Special Coatings.

SECTION 400519 – DUCTILE IRON PROCESS PIPE AND FITTINGS

PART 3 -- EXECUTION

3.1 INSTALLATION OF PIPE

- A. The CONTRACTOR shall inspect each pipe and fitting prior to installation to insure that there are no damaged portions of the pipe. Pipe damaged prior to Substantial Completion shall be repaired or replaced by the CONTRACTOR.
- B. For exposed piping installation and testing, refer to Section 400505, Exposed Piping Installation.

END OF SECTION

SECTION 400553 – PROCESS VALVES

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. SCOPE: The work covered by this section includes the furnishing and installation of interior valves and appurtenances, completed and operable, as indicated in the Contract Documents.
- B. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls, as indicated.

1.2 REFERENCE DOCUMENTS

- A. ANSI MSS SP-81-2013.
- B. ASME B16.5
- C. ASTM A126

1.3 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Assembly drawings indicating part nomenclature, materials, dimensions, weights, and relationships of handles, operators, position indicators, limit switches, and control systems
- B. Informational Submittals: Submit the following:
 - 1. Spare parts list,
 - 2. Operation and Maintenance manual
 - 3. Factory test data and certification of quality and test results for factory-applied coatings.

1.4 WARRANTY

- A. Valves and actuators shall be warranted by the manufacturer for defects in materials and workmanship for a period of two (2) years.

PART 2 -- PRODUCTS

2.1 KNIFE GATE VALVES

- A. Valves shall be bonnetless cast stainless steel knife gate valve with 150 psi cold working pressure (CWP) rating.
- B. Manufacturer/Model: DeZurik KGC or Engineer approved equal.
- C. Gate side edges: shall be machined, finished, and rounded. Gate faces shall be finished ground. Valve shall be of wafer style and have a solid one piece cast body.

SECTION 400553 – PROCESS VALVES

- D. Packing System: shall consist of multiple layers of packing. The packing system shall be for wet service. The packing gland shall match the valve body material. The fasteners shall be stainless steel.
- E. Body: shall be a one-piece casting of type 316 stainless steel for corrosive applications. Metal seated valve body shall incorporate rugged guides and jams to support and wedge the gate against the seat. Valve inside port diameter shall conform to MSS SP-81 requirements for both metal and resilient seated valves.
- F. Seat: Valve shall be metal seated, providing shutoff capability to MSS SP-81.
- G. Face to Face Dimension: shall meet MSS SP-81.
- H. Flange Drilling: shall be in accordance with ASME B16.5 class 150.
- I. Actuation: shall be power actuated and furnished with an air cylinder actuator. Actuator shall be sized to operate with 30 psi cylinder pressure at a maximum shutoff pressure of 100 psi. The power actuator yoke shall be a two-piece design of 316 stainless steel or cast ductile iron.

2.2 FLEXIBLE DISC CHECK VALVES

- A. The valves shall be full flow body type with flexible disc check capable of passing a 3” spherical solid, suitable for wastewater service up to a cold working pressure of 250 psig, with domed access cover, disc accelerator, and manual backflow actuator, and disc position indicator.
- B. Manufacturer/Model: Valves shall be Surgebuster® Swing Check Valve Series #7200 as manufactured by Val-Matic® Valve and Mfg. Corp., or Engineer approved equal.
- C. The valve shall contain a one piece disk accelerator to provide rapid closure of the valve, enclosed within the valve, field adjustable or replaceable without removing the valve from the line.
- D. A screw type backflow actuator shall be provided allowing opening of the valve during no-flow conditions. Buna-N (NBR) seals shall be used to seal the stainless steel stem in a lead-free bronze bushing. The backflow device shall be of rising-stem type to indicate position. A stainless steel t-handle shall be provided for operation.
- E. A mechanical valve position indicator shall be provided and maintain continuous contact with the disc under all operating conditions to assure accurate indication.
- F. A pre-wired limit switch shall be provided with the valve to indicate open/closed position to a remote location. The limit switch will be activated by the mechanical indicator, rated for NEMA 4, have UL rated 4 amp, 24 VDC rating, Allen-Bradley Compact Limit Switch 802B-CSACXSXC3 or Engineer approved equal.

2.3 SWING CHECK VALVES

- A. Swing check valve shall be self-contained, free swinging disc style, allowing a clear waterway. The valve shall have a bolted cover (bonnet) allowing access to the disc without removing the valve from the line, and integral cast flanges. Valve cushion and lever arm system shall be externally mounted. Valve shall be furnished with weight, air cushion, and valve position sensor.

SECTION 400553 – PROCESS VALVES

1. Manufacturer/Model: Pratt® Series 8501 Ductile Iron AWWA Swing Check Valve, with air cushion with outside lever and weight
- B. Pressure Rating: 150 psi working pressure.
- C. References:
1. ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings Class 125.
 2. AWWA C508: Swing Check Valves for Waterworks Service 2” through 24” NPS.
- D. Materials:
1. All cast iron conforming to ASTM A126 CLB
 2. Disc: Ductile iron conforming to ASTM A536 GR65-45-12
 3. Hing Pins: Stainless Steel conforming to ASTM A276 GR304
 4. Seat Rings: Stainless Steel conforming to ASTM A276 GR316, BUNA-n face gasket.
 5. Coating: 8 mils internal and external two-component epoxy conforming to AWWA C550.
 6. Valve Position Sensor: Dwyer Proximity® Series DT Detector Position Sensor, Model DT1060 or Engineer approved equal.
 - a. 24 VDC, factory sealed leads with 18” minimum 4 conductor, PVC insulated, 18 AWG – Green/Red/Black/White (Ground/NC/NO/Common).
 - b. 316 Stainless steel housing, 5/8”-18 UNF external threads and a ½”-14 NPT conduit entrance.
 - c. Enclosure rating: Weatherproof; hermetically sealed; explosion proof UL & CSI Listed for Class I, Groups A, B, C, & D; Class II, Groups E, F, and G. Divisions 1 & 2.
- Valve Position Sensor Bracket: Fabricated aluminum bracket for mounting on ANSI B16.1 Class 125 flange.

2.4 BALL VALVES

- A. Standard Ball Valves: 2 Inches and Less: Ball valves shall be constructed of stainless steel with 316 SS ball and reinforced TFE seats. Valves shall be full port with blowout proof stem. Valve operator shall be handle operated. Valves shall be Apollo, Series 76, or approved equals.

2.5 ECCENTRIC PLUG VALVES

1. Eccentric Plug Valves shall be of the tight closing, resilient faced, non-lubricating variety and shall be of eccentric design such that the valves pressure member (plug) rises off the body seat contact area immediately upon shaft rotation during the opening movement. Valves shall be drop-tight at the rated pressure (175 psi through 12", 150 psi 14" and above) and shall be satisfactory for applications involving throttling service as well as frequent or infrequent on-off service. The valve closing member should rotate approximately 90 degrees from the full-open to full-close position and vice-versa.

SECTION 400553 – PROCESS VALVES

2. The valve body shall be constructed of cast iron (semi-steel) conforming to ASTM A126, Class B. Body ends shall be:
 - a. Flanged with dimensions, facing, and drilling in full conformance with A-ANSI B16.1, Class 125.
 - b. Eccentric Plug Valves shall have a rectangular shaped port. Port areas for 3" - 20" valves shall be a minimum 80% of full pipe area. Port area for valves larger than 20" diameter shall be 70%.
3. Valve seat surface shall be welded-in overlay, cylindrically shaped of not less than 90% pure nickel. Seat area shall be raised, with raised area completely covered with weld to insure proper seat contact. The machined seat area shall be a minimum of 0.125 thick and .500" wide.
4. The valve plug shall be constructed of cast iron (semi-steel) conforming to ASTM-A126, Class B. The plug shall have a cylindrical seating surface that is offset from the center of the plug shafts. The plug shafts shall be integral. The entire plug shall be 100% encapsulated with Buna-N rubber in all valve sizes. Where 100% encapsulation is not available the plug shall have a rubber facing. The rubber compound shall be approximately 70 (Shore A) durometer hardness. The rubber to metal bond must withstand 75 lbs. pull under test procedure ASTM D-429-73 Method B.
5. Shaft bearings, upper and lower, shall be sleeve type metal bearings, sintered, oil impregnated, and permanently lubricated type 316 stainless steel conforming to ASTM A Grand C-8M. Thrust bearings shall be Nylatron.
6. Plug valve shaft seals shall be of the multiple V-ring type (Chevron) and shall be adjustable. All packing shall be replaceable without removing the bonnet or actuator and while the valve is in service. Shaft seals shall be made of Buna N.
7. Each valve shall be given a test against the seat at the full rated working pressure and a hydrostatic shell test at twice the rated working pressure. Certified copies of individual tests shall be submitted when requested. Certified copies of proof-of-design tests shall be submitted upon request.
8. Manual valves shall have worm gear type actuators with handwheels or chainwheels.
 - a. Chainwheels shall be provided on all valves as indicated in the drawings. Chainwheels shall be constructed of epoxy coated ductile iron equipped with a chain guide arm and cap. Chains shall be galvanized steel provided by the manufacturer.
9. All eccentric plug valves shall be Milliken series 600, Clow, DeZurik Series 100, or approved equal.
10. Unless otherwise necessary for proper operation or permitted by the ENGINEER, all eccentric plug valves shall be installed with the shaft horizontal and the plug in the upper half of the valve body. Valves in sewage or sludge lines shall be installed with the seat on the upstream end.

PART 3 -- EXECUTION

3.1 INSPECTION

SECTION 400553 – PROCESS VALVES

- A. Examine conditions under which materials and equipment are to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install valves and appurtenances in accordance with:
 - 1. Supplier's instructions and the Contract Documents.
 - 2. Install valves plumb and level. Install all valves to be free from distortion and strain caused by misaligned piping, equipment, and other causes.
- B. Exposed Valves:
 - 1. Provide supports for large or heavy valves and appurtenances as shown or required to prevent strain on adjoining piping.
 - 2. Operators:
 - a. Install valves so that operating handwheels or levers can be conveniently turned from operating floor without interfering with access to other valves, piping, structure, and equipment, and as approved by ENGINEER.
 - b. Avoid placing operators at angles to floors or walls.
 - c. Orient chain operators out of way of walking areas.
- C. Install valves so that indicator arrows are visible from floor level.
- D. Floor Stands and Stems:
 - 1. Install floor stands as shown and as recommended by manufacturer.
 - 2. Provide lateral restraints for extension bonnets and extension stems as shown and as recommended by manufacturer.
 - 3. Provide sleeves where operating stems pass through floor. Extend sleeves two inches above floor.
- E. Plug Valves:
 - 1. Install plug valves that are in horizontal liquid piping with stem horizontal and plugs on top when valve is open. Plug shall be on upstream end when valve is closed.
 - 2. Install plug valves that are in vertical liquid piping with plug at top when closed or as recommended by valve Supplier.
 - 3. Supplier shall tag or mark plug valves to indicate proper mounting position.

3.3 FIELD QUALITY CONTROL

SECTION 400553 – PROCESS VALVES

A. Field Tests:

1. Adjust all parts and components as required to provide correct operation of valves.
2. Conduct functional field test on each valve in presence of ENGINEER to demonstrate that each valve operates correctly.
3. Demonstrate satisfactory opening and closing of valves at specified criteria requiring not more than 40 pounds effort on manual actuators.
4. Test ten percent of valves of each type by applying 200 pounds effort on manual operators. There shall be no damage to gear actuator or valve.
5. Motor operated valves.
 - a. Provide services of qualified factory-trained service technicians to check and approve installation of the valve and actuator. Supplier's serviceman shall perform the following:
 - i. Supervise installation of equipment.
 - ii. Inspect and adjust equipment after installation and ensure proper operation.
 - iii. Instruct OWNER's personnel in operating and maintaining the equipment.

END OF SECTION

SECTION 400559.33 – CAST IRON SLIDE GATES

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide slide and weir gates, complete and operable, in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit the following:

- a. Drawings of gates, frames, slides, and actuators. Catalog cuts and general arrangement drawings of the gate assemblies are not considered acceptable for shop drawings.
- b. Design load calculations for slide and frame deflection at the design head to confirm compliance with the safety factors specified in AWWA C561. In particular, load calculations for the slide shall be provided for the centerline of the slide as well as each edge of the slide, where it engages the frame.
- c. Design calculations indicating the maximum required opening and closing forces under the design seating and unseating heads
- d. Where a gate operator is indicated in the Gate Schedule as manual, submit calculations for the lifting force generated by 40 pounds effort on the crank.
- e. Where a gate operator is indicated in the Gate Schedule as electric, actuator information shall be submitted with the gate shop drawings as a complete package clearly indicating the output forces of the actuator versus the required opening and closing forces under the design seating and unseating heads.
- f. Stem buckling design calculations shall be submitted indicating the proper sizing of the stem and proper spacing of stem guides in accordance with the applicable standards.
- g. Seismic anchorage calculations shall be sealed by a registered professional civil engineer.

1.3 QUALITY ASSURANCE

- A. The leakage allowance for slide gates under the design seating and unseating heads shall conform to AWWA C561 – Fabricated Stainless Steel Slide Gates.
- B. All welds shall be performed by welders with AWS D1.6 certification. Certificates shall be included in the shop drawing submittal.
- C. Factory Testing
 - 1. Gates shall be factory-assembled and functionality-tested prior to delivery to the Site.
 - 2. Test certificates shall be submitted.

SECTION 400559.33 – CAST IRON SLIDE GATES

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Gates shall comply with the following Standards:
 - 1. AWWA C560 Cast-Iron Slide Gates
- B. Gates shall be new and of current manufacture, adequately braced in order to prevent warpage and bending under the intended use.
- C. Gate actuators shall be sized, selected, and furnished by the gate manufacturer.
- D. Electric actuators throughout the project shall be as manufactured by AUMA.
- E. Mounting Requirements
 - 1. The lifting devices shall be mounted on pedestals constructed of 316 stainless steel. The pedestals shall have an ample base or bracket area to evenly distribute the load to the supporting concrete structure.
 - 2. Where indicated in the drawings, pedestals for non-self-contained gates shall be mounted directly to the wet well slab. Positioning of the pedestal shall be such that there is minimal strain on the gate stem due to misalignment between the attachment of the stem to the gate and the pedestal.
- F. Construction
 - 1. Unless otherwise indicated, materials of construction shall be in accordance with AWWA C560 suitable for the service. All structural parts of the gate assembly shall have a minimum thickness of ¼-inch.
 - 2. After fabrication, all weld burn and weld slag shall be removed by mechanical passivation in accordance with ASTM A380.
 - 3. The slide shall not deflect more than 1/720 of the span or 1/16 inch, whichever is less, under the design head.
 - 4. The gate shall utilize self-adjusting seals. Due to the difficulty of accessing gates when they are in service, gates that utilize wedges requiring field adjustment are not acceptable for this project.
 - 5. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
 - 6. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place solely with adhesives are unacceptable.
 - 7. Materials used in the fabrication of the slide gates shall conform to the requirements of the standards designated for each material as indicated below:

SECTION 400559.33 – CAST IRON SLIDE GATES

Description	Material Standards
Cast Iron Gates	
Frame, Slide, and Pedestals	Cast Iron ASTM A126 Class B
Stems	Stainless Steel ASTM A276 AISI Type 304 or better
Stem guides	Cast Iron ASTM 126 Class B Bronze Bushed
Wedges and Stem Blocks	Low-Zinc Bronze ASTM B98 C65100 (Waterman), Manganese Bronze, ASTM B584, Alloy 865 (Meuller), or approved equal
Hardware	ASTM F593/F594, Type 316, All necessary attaching bolts and anchor bolts shall be furnished by the slide gate manufacturer.
Stem Cover	Fracture-resistant clear lexan or butyrate plastic stem covers complete with indicator markings to indicate gate position.
Seats	Naval Bronze ASTM B21 Alloy 48200 (Waterman), Silicon Bronze, ASTM B98, Alloy 651 (Meuller), or approved equal
Finishes	High-solids epoxy
Seals	Self-adjusting UHMWPE seal system, bolted to the guide or slide and be field replaceable without the need to remove the gate from the wall.

G. Lifting Devices

1. Provide lifting devices complete with stem, lifting nut, intermediate supports with steady bushings, interconnecting shafts with flexible couplings and stainless steel hardware (when shown on the Contract Drawings), stem cover with position indicator, and gear reducer, crank, electric or hydraulic cylinder, where indicated.
2. The lifting devices' enclosures shall be NEMA 4 weatherproof.
3. Pedestal Mounting
4. The centerline of the manual actuator shall be approximately 3 feet above the base for pedestal-mounted actuators, and approximately 4 feet above the floor for frame-mounted actuators.
5. Slide gate hoist heads shall be constructed of cast iron, ductile iron or cast aluminum. Operating nut shall be bronze. Gearboxes shall have stainless steel input shafts. The input shafts shall be supported by ball thrust or roller bearings. Mechanical seals shall be provided.
6. Stems shall have a minimum diameter of 1-1/2 inch designed to withstand at least twice the maximum output of the gate actuator in a stalled condition. The stem shall have a slenderness ratio (L/R) less than 200. The full depth Acme threads shall be machine rolled or machine cut with a 16 microinch or better surface finish. Acme stub threads shall not be allowed. Stems shall be constructed of stainless steel Type 304 solid round bar. Pipe extensions are not acceptable. The operating nut shall be constructed of solid bronze, in accordance with ASTM B584. Operating thrust shall be taken on roller or ball bearings.

Stem covers shall be sealed to prevent water intrusion and shall allow a means to visibly confirm stem elevation. Covers shall not discolor or become opaque for a minimum of 5 years after installation. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting.

SECTION 400559.33 – CAST IRON SLIDE GATES

7. Crank
 - a. The unit shall be designed for a 40–pound maximum effort on the crank at the design head to operate the gate.
 - b. The “open” direction shall be provided on the operator assembly. Clockwise movement of the crank shall close the gate.
 - c. A 2-inch square nut shall be mounted to each input shaft. The operating crank shall be easily removable to facilitate the use of a portable power operator.
- H. Manufacturers, or Equal
 1. Waterman Industries
 2. Hydro Gate Corp. (a Mueller brand)

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Slide gate shall be wall mounted with an extended flange back for use with the existing thimble at West Juneau Pump Station and wall mounted with a cast-in-place, Type F thimble at Outer Drive Pump Station. Contractor shall field verify thimble bolt pattern for gate manufacturer’s use in fabricating the extended flange back.
- B. Installation of the gates shall be performed in strict accordance with standard industry practices. Contractor shall handle, store, and install gate and equipment specified in this section in accordance with the gate manufacturer’s recommendations.
- C. Slide gate frames shall be installed square and plumb with no twist, convergence, or divergence between the vertical legs of the guide frame. Contractor shall fill any gap between the gate frame and wet well wall with non-shrink grout in accordance with the grout manufacturer’s recommendations.
- D. Slide gate stem shall be installed vertically between the pedestal and gate. Twisting, bending, or torquing to fit shall not be allowed.
- E. After installation, all slide gates will be field tested in the presence of a certified professional engineer and the owner to confirm that leakage does not exceed the specified allowed leakage per AWWA C560.

SECTION 400559.33 – CAST IRON SLIDE GATES

SLIDE GATE SCHEDULE

Gate Tag Number	Gate Opening Width x Height (inches)	Mounting Arrangement	Opening Direction	Design Head (feet)		Actuator Type
				Seating	Unseating	
SG201	18 x 18	Wall Mount*	Downward	5	20	Hand Wheel**
SG101	30 x 30	Thimble - F	Downward	5	20	Hand Wheel**

**Gate shall be wall-mounted with an extended flange back for use with the existing thimble*

***Hand wheel lift shall be furnished with square nut adapters to be used with a portable power operator for non-rising stem application*

END OF SECTION

SECTION 400559.33 – CAST IRON SLIDE GATES

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SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The System Integrator (SI) shall provide all Process Control and Instrumentation System (PCIS) Commissioning including all programming and configuration complete and operable, in accordance with the Contract Documents. Due to the complexities associated with the interfacing of numerous control system devices, it is the intent of these Specifications that the System Integrator be responsible for the integration of the PCIS with devices provided by others, with the objective of providing a completely integrated control system free of signal incompatibilities.

B. The requirements of this Section include:

1. Coordination with the general CONTRACTOR to ensure all power, control and monitoring wiring and signals between the CONTRACTOR supplied motor starters, motor actuated valves, instrumentation, etc. and the SCADA Control Panel 'SCP' are correctly connected, compatible, communicating and functioning.
2. Coordinate with the City and Borough of Juneau's (CBJ's) SCADA System Manager as necessary to ensure that the SMS Ethernet network communications between the 'SCP', SMS access gateway/router, the head-end SCADA client server equipment is correctly connected, compatible and functioning via radio.
3. Coordinate with the OWNER to verify proper operation of the local control panel 'SCP' is providing all required alarming functions to .
4. Coordinate with the OWNER to verify proper operation of the process variable trending, recording and reporting functions on their head-end SCADA desktop PC and cellular SMS messaging.
5. Any incompatibilities, wiring deficiencies, signal conflicts or other issues which prevent proper start-up and operation of the PCIS shall be brought to the attention of the ENGINEER immediately so that a resolution can be made.

C. Responsibilities: As a minimum, the System Integrator shall perform the following WORK:

- a. Oversee, document, and certify loop testing
- b. Perform start-up, testing and commissioning
- c. Ensure the local station 'SCP' is communicating required data properly over the cellular SMS radio link to the City's SCADA head-end client server/desktop PC.
- d. Prepare Technical Manuals
- e. Prepare edited set of WTCP record drawings

SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Division 01 and the following:

1. The SI shall coordinate with the CONTRACTOR's 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 SI 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. Symbology and Nomenclature: In these Contract Documents, all systems, all meters, all instruments, and all other elements are represented schematically, and are designated by symbology 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 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 Drawings.
4. Commissioning Test Plan Submittal: The CONTRACTOR shall submit a commissioning test plan including:
 - a. A complete index which lists the sequential steps to be taking from individual device check-out to complete system on-line operation. Steps shall include, but not be limited to individual I/O loop tests and calibration, individual equipment performance testing, subsystem testing and overall system final acceptance testing.
 - b. For each step provide the following:
 - 1) A description of the tests being performed and the procedures to be taken. Most of the step descriptions/procedures should match the requirements stated in the system functional narrative and civil pump sequence details. An example is a pump that is described in the Functional Narrative as having Hand-Off-Auto operations shall be tested in each mode to ensure it operates as required per the functional narrative or functions as intended by the station operators.
 - 2) List of personnel that are required to perform the work – electrician, plumber, general CONTRACTOR, equipment vendor, Owner's representative, etc.
 - 3) Test equipment required – multimeter, insulation resistance tester, etc.
 - 4) Materials required – fuel, water supply, chemicals, etc.
 - 5) List of equipment required to be operational to perform the test. An example is a variable frequency drive and pressure transmitter would need to be operational prior to testing a pressure pump that varies its speed to maintain a set pressure.

SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

- 6) List of any safety precautions or parts of process systems that need to be isolated to perform the tests.
 - c. Test plan shall include sample forms to be completed during device calibration and loop testing. For each device or instrument include a Summary sheet with the following information:
 - 1) Project tag number and component functional description used in the Contract Documents
 - 2) Manufacturer's model number or other product designation
 - 3) Project system or loop of which the component is a part
 - 4) Project location or assembly at which the component is to be installed
 - 5) Input and output characteristics
 - 6) Scale, range, setpoints, units, and multiplier (if any)
 - 7) Requirements for electric supply (if any)
 - 8) Requirements for air supply (if any)
 - 9) Materials of component parts to be in contact with or otherwise exposed to process media and corrosive ambient air
 - 10) Special requirements or features
5. Test Plan Submittals
- a. The SI shall submit the proposed plan to be followed during tests of the PCIS and its components. Submit plan a minimum of two weeks prior to start of testing to allow for review and approval by the ENGINEER.
 - b. No testing shall begin until the test plan has been approved by the ENGINEER.
- B. PCIS Operations and Maintenance (O&M) Manual
1. General: Information in the O&M Manual shall be based upon the approved Shop Drawing submittals as modified for conditions encountered in the field during the WORK.
 2. The O&M Manual shall have the following organization for each process:
 - a. Section A – Edited As-Built Drawings
 - b. Section B – Instrument/Device Summary Sheet as described in paragraph 1.2.A.4.c above.
 - c. Section C – Instrument/Device Data Sheets. Data sheets shall be provided for each device identified by tag number, type, and manufacturer. A separate manufacturer's technical brochure or product data sheet shall be included for each instrument (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

SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

include a list of tag numbers for which it applies. System groups shall be separated by labeled tags. Data sheets shall clearly identify the appropriate catalog/make/model number, and all provided options, accessories and features.

- d. Section D – Instrument/Device Installation Details
 - e. Section E – Test Results
3. Signed results from Loop Testing and the Final Performance Test report.
 4. Initially, a draft of the O&M Manual shall be submitted for review. Following the ENGINEER's review, one set will be returned to the SI with comments. The Manuals shall be revised and amended as required and the final Manuals shall be submitted prior to final completion.

C. Record Drawings

1. The SI shall keep current a set of complete loop and schematic diagrams which shall include all field and panel wiring, routing, mounting details, point-to-point diagrams with cable, wire, and termination numbers. These drawings shall include all instruments and instrument elements. Two sets of drawings electronically formatted in AUTOCAD on CD-ROM 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 ENGINEER.

1.3 WARRANTY

- A. The warranty shall start from the date of final acceptance of the completed project and shall extend for 1 year.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Instrument and Loop Power: Power requirements and input/output connections for all components shall be verified. Power for transmitted signals shall, in general, originate in and be supplied by the control panel devices. The use of "2-wire" transmitters is preferred and use of "4-wire" transmitters shall be minimized. Individual loop or redundant power supplies shall be provided as required by the manufacturer's instrument load characteristics to ensure enough power to each loop component. Power supplies shall be mounted within control panels or in the field at the point of application.
- B. Loop Isolators and Converters: Signal isolators shall be provided as required to ensure adjacent component impedance match where feedback paths may be generated, or to maintain loop integrity during the removal of a loop component. Dropping precision wirewound resistors shall be installed at all field side terminations in the control panels to ensure loop integrity. Signal conditioners and converters shall be provided where required to resolve any signal level incompatibilities or provide required functions.
- C. Signal Levels: Analog measurements and control signals shall be as indicated herein, and unless otherwise indicated, shall vary in direct linear proportion to the measured variable. Electrical

SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

signals outside control panels shall be 4 to 20 mA DC, except as indicated. Signals within enclosures may be 1-5 VDC. Electric signals shall be electrically or optically isolated from other signals.

PART 3 -- EXECUTION

3.1 TAGGING

- A. Each component shall be tagged with an instrument or equipment tag number in accordance with the contract P&ID drawings. A permanent stainless-steel tag firmly attached and stamped with the instrument/equipment tag number shall be provided on each piece of equipment in the PCIS. Identification shall be prominently displayed on the outside of the package.

3.2 INSTALLATION

- A. General: The SCP and all PCIS instruments, equipment and devices shall be installed by the CONTRACTOR.
- B. Conduit, Cables, and Field Wiring. All conduit, cables and field wiring run between the SCP and all field devices including instrumentation, motor starters, etc. shall be provided by the CONTRACTOR. The CONTRACTOR shall also terminate and provide wire identification for all field conductors. Conductors shall be terminated and identified at the SCP in accordance with the SI provided shop drawings.
- C. Cellular Network Cabling: All required CAT 6A copper network, coaxial cabling and conduit between the SCP and the AP&T service equipment shall be provided by the CONTRACTOR.
- D. The SI shall coordinate with the CONTRACTOR to verify the correctness of each PCIS field device and instrument installation, including polarity of electric power and signal connections, and make sure process connections are free of leaks. Any issues or discrepancies shall be corrected.
- E. The OWNER will not be responsible for any additional cost of rework attributable to actions of the CONTRACTOR or the System Integrator.

3.3 CALIBRATION

- A. General: PCIS instruments and devices 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 25, 50, 75 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 need adjustment. Such adjustments, if required, shall be made only after consultation with the ENGINEER.

SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

- D. Field Calibration: Instruments that were not bench-calibrated shall be calibrated in the field to ensure 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 25 percent, 50 percent, 75 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 System Integrator 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 System Integrator sign the tag when calibration is complete. The ENGINEER will sign the tag when the calibration and testing has been accepted.

3.4 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 SI 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.

SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

- B. Control Valve Tests: Control valves, cylinders, drives and connecting linkages shall be stroked from the operator interface units as well as local control devices and adjusted to verify proper control action, hand switch action, limit switch settings, torque settings, remote control actions, and remote feedback of valve status and position. Control valve actions and positioner settings shall be checked with the valves in place to ensure that no changes have occurred since the bench calibration.
- C. 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.
- D. Discrete Inputs/Outputs: All discrete I/O devices and instruments including hand switches, limits switches, pressure/temperature/level/flow switches, motor control signals, alarm lights/horns, etc. shall be field tested to ensure proper response/operation in accordance with the Functional Narrative.
- E. 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.
- F. Loop Validation Sheets: The CONTRACTOR shall prepare loop confirmation sheets for each loop covering each active instrumentation and control device as described in paragraphs B-E above. 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 System Integrator and ENGINEER:
1. Project name
 2. Loop number
 3. Tag number, description, manufacturer and model number for each element
 4. Specification section number
 5. Adjustment check
 6. Confirmation check box for proper PLC I/O point and address or register.
 7. Confirmation check box for proper HMI response, display, tag value and description.
 8. Space for comments
 9. Space for loop sign-off by System Integrator and date
 10. Space for ENGINEER witness signature and date

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G. 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.

3.5 SCADA SMS GATEWAY ACCESS

A. The SMS cellular gateway/router shall be configured to allow remote access to the City's SCADA client network.

1. Make all required PLC/HMI software programming changes if user has valid administrator access.

B. Remote access shall be demonstrated via the head-end remote SCADA client PC/Server.

C. The alarming function of the local PLC/HMI shall be demonstrated by simulating each programmed alarm condition and verifying the proper alarm message is sent and received via SMS cellular network to the remote SCADA client PC and designated station operator cell phones.

3.6 PROCESS VARIABLE TRENDING AND REPORTING

A. Each of the system's process variables that are monitored by the SCP shall be recorded and their trend over time displayed on the OWNER's remote SCADA client PC/Server.

B. Critical variables such as flow rate that are required to be reported by the Alaska Department of Environmental Conservation (ADEC) shall be automatically compiled into a report in a format acceptable to the ADEC. Variables shall be recorded every 15 minutes only when flow through the system occurs.

3.7 INDIVIDUAL EQUIPMENT AND SUBSYSTEM TESTING

A. After completion of the loop tests, the individual equipment and subsystem testing shall be performed in accordance with the approved Testing Plan.

B. All parties identified in the Testing Plan shall be present during the appropriate individual equipment or subsystem testing including manufacturer or supplier representatives.

C. Individual equipment tests shall be done in accordance with the equipment manufacturer's recommendations.

D. The tests shall demonstrate the proper operation of the equipment and/or subsystem as required in the Functional Narrative. The tests shall also demonstrate the proper performance characteristics of the equipment such as flowrate, pressure range, speed, etc.

E. The final value for all equipment adjustable configuration parameters such as setpoints, dip switch settings, programmable settings, etc. shall be recorded for inclusion in the O&M manual.

3.8 FINAL ACCEPTANCE TEST

SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND COMMISSIONING

- A. Once all equipment and subsystem tests have been complete and results accepted by the ENGINEER, the complete PCIS system shall be put into service for a Final Acceptance Test. The OWNER and ENGINEER shall be notified a minimum of 48 hours prior to the start of this test.
- B. The entire PCIS system including the SCP, remote SCADA Client PC/Server connection, hardware, field instruments, power supplies, and wiring shall operate in accordance with the Specifications and Functional Narrative for 30 days without failure.
- C. If any component, other than field instruments, fails during the final acceptance test, it shall be repaired or replaced and the PCIS shall be restarted for another 30-day period.
- D. The SI and CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.

3.9 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

- A. For the purpose of this Section, the following 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 OWNER.
 - 4. The individual equipment, subsystem and final acceptance tests have 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 O&M Manuals that may have resulted from the field tests have been made and reviewed.

END OF SECTION

**SECTION 40 61 00 - PROCESS CONTROL AND INSTRUMENTATION SYSTEM AND
COMMISSIONING**

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SECTION 40 63 00 - CONTROL PANELS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. General: The System Integrator (SI) shall provide a programmable logic controller (PLC) based SCADA Control Panel (SCP), complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 90 00 – Process Control and Instrumentation System Commissioning apply to this Section.
- C. The panel shall be built by a UL 508A listed panel shop to UL, ETL, or other independent testing laboratory standards acceptable to the State of Alaska Mechanical Inspections Division. The panels shall have UL or ETL 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.
- D. System Integrator (SI): It is the intent of these Specifications to have the SI be singularly responsible for selecting and verifying correct operation of compatible hardware to provide a functional SCP and to provide future support of all SCP operation.
- E. Minimum System Integrator Scope:
 - 1. Procurement of all hardware and software required to conform to these Specifications.
 - 2. Design and submit PLC hardware, software and spare parts submittals.
 - 3. Perform all required PLC hardware tests, software programming, adjustments, and calibrations.
 - 4. Furnish all required PLC tools, test equipment, spare parts, supplies, operations and maintenance manuals, and reproducible record drawings as specified herein.

1.2 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be furnished in accordance with Division 01 Submittal Procedures.
- B. Control Panel Shop Drawings:
 - 1. Shop Drawings shall include the letterhead or title block of the System Integrator. The title block shall include, as a minimum, the SI's registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing.
 - 2. Organization of the Shop Drawing submittals shall be compatible with eventual submittals for later inclusion in the O&M Manual.
 - 3. 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.

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4. 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 drawings being indexed by systems or process areas. All panel tagging, and nameplate nomenclature shall be consistent with the requirements of the Contract Documents.
5. The submittal shall completely define and document the construction, finish, fuses, circuit breakers, internally-mounted hardware, communications hardware, and PLC system components. Interfaces required 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 SCP Shop Drawing submittal.
6. 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 submitted as a singular complete bound volume or multi-volume package and shall have the following contents:
 - a. 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 shelf locations, and lifting lug material and locations.
 - b. Scaled panel layout drawings showing exterior panel face and interior back panel layouts with all components and devices shown.
 - c. Complete wiring diagrams showing all panel interior wiring identifying 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. These wiring diagrams shall also show location and identify terminals for all field wiring connections.
 - d. Complete loop drawings showing all wiring connections to field devices, equipment, and instruments.
 - e. Manufacturer's data sheets for all components included in the panel. Data sheets shall clearly define the electrical, environmental, and physical characteristics and limitations of each component. Any optional features to be included shall be clearly defined and where multiple options, models, catalog numbers are shown, the ones being provided shall be clearly identified.
 - f. Complete and detailed bill of materials: A bill of material list, including quantity, description, manufacturer, and part number, shall be submitted for all components of the SCP.
 - g. Representative Human-Machine-Interface (HMI) graphical screen shots. HMI screens shall accurately represent the overall system process. Individual screens shall be provided to show the overall system, an alarm log and major process trend historical graphs.

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- C. Owner's Manuals: General requirements for Owner's Manuals are as described in Section 40 90 00 – Process Control and Instrumentation Systems Commissioning. The following items shall also be included in the Owner's manual:
 - 1. Operation and maintenance manuals for all PLC hardware as specified herein.
 - 2. Electronic and hardcopy of PLC and HMI annotated software programs.
 - 3. Remote access gateway configuration files.
- D. Factory Test Procedure: The System Integrator shall prepare and submit a factory test procedure which incorporates test sequences, test forms, samples of database lists, a PLC testing block diagram, and an estimated test duration which comply with the requirements of the factory test specified herein.

1.3 WARRANTY

- A. The SI shall warrant the control panel for a period of one year from all component failures, defects, or software programming issues. Warranty shall cover the cost of all repair work and any required shipping or travel expenses.

PART 2 -- PRODUCTS

2.1 CONTROL PANEL

- A. All materials and all SCP equipment furnished under this Contract shall be new, free from defects, of first quality, and produced by manufacturers regularly engaged in the manufacture of these products.
- B. Hardware Commonality: Where there is more than one item of similar equipment being furnished all such similar equipment shall be the product of a singular manufacturer.
- C. ENCLOSURE
 - 1. The PLC and its corresponding I/O modules, power supply module(s), communication interface device(s) and peripheral equipment shall be mounted inside a suitable enclosure. All I/O wiring from the field to the I/O modules shall be terminated on terminal blocks in the enclosure.
 - 2. Enclosure shall be NEMA 4X, 16-gauge or 14-gauge thickness, Type 304 or 316L stainless steel.
 - 3. Enclosures shall have stainless steel continuous hinges and door handle with 3-point latch. Covers with multiple hasps or latches are not acceptable.
 - 4. Finish shall be unpainted, smooth brushed finish.
 - 5. Enclosures and Panels shall be as manufactured by Hoffman, or equal.
- D. Operating Conditions: The SCP shall be designed and constructed for satisfactory operation and long, low maintenance service under the following conditions:

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1. Environment - water treatment/supply facility
 2. Indoor Temperature Range - 32 through 84 degrees F
 3. Relative Humidity - 20 through 90 percent, non-condensing
- E. Each panel shall be provided with a 120-volt, switched LED style light fixture, as shown on the Drawings. The fixture shall be **Hoffman model #LEDA1S35**, or equal.
- F. Each panel shall be provided with a 120-volt, 20amp rated, NEMA 5-20R duplex convenience receptacle, **Hubbell #5362**, or equal.
- G. Power Supply 24 VDC: Each panel shall be supplied from either a battery-backed 24 VDC power supply or an uninterruptible power supply (UPS) and 24 VDC power supply as shown on the drawings. Batteries shall be provided to support a minimum of 15 minutes of runtime during a power interruption under normal load. The UPS shall be 120V input/ 120V output, sized for the connected kVA load plus a minimum of 20%. The UPS shall be **Liebert model# GXT4-2000RT120** or equal. The 24 VDC power supply shall be 120V input, 24 VDC output, 5 amp minimum, DIN-rail mounted **Quint4 # PS/1AC/24DC/5** or equal.
- H. 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 **Allen Bradley model# 4983-DC120-20**, **Advance Surge Suppressor model TSP-WG6-120VAC-10A-01**, **Control Concepts 'Islatrol Elite' model IE-110**, or equal.
- I. 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.
 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.

2.2 PROGRAMMABLE LOGIC CONTROLLER (PLC)

- A. General: Each PLC shall be of solid-state design. All central processor (CPU) operating logic shall be contained on plug-in modules for quick replacement. Chassis-wired logic is not acceptable. The controller shall be capable of operating in a hostile industrial environment and designed to provide high reliability specifically in this process application. The internal wiring of the controller is to be fixed; with the logic functions it must perform in each application to be programmed into its memory. The controller shall be supplied with the CPU, input/output scanner, inputs, outputs, memory, power supply, and all power and interface cables necessary to function as a complete and operable PLC system.
- B. Design: Each PLC shall have all the facilities required to implement the control schemes and database indicated. PLCs shall have the following functions and features:

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1. Modular, field-expandable design allowing the system to be tailored to this process control application. The capability shall exist to allow for expansion of the system by the addition of hardware and/or user software.
 2. The processor plus input and output circuitry shall be of a modular design with interchangeability provided for all similar modules. Modules are defined herein as devices that plug together to form an interlocking modular chassis. The design must prohibit upside-down insertion of the modules.
 3. The PLC shall have downward compatibility whereby all new module designs can be interchanged with all similar modules to reduce obsolescence.
 4. All hardware shall operate at an ambient temperature of 0 to 60 degrees C (32 to 140 degrees F), with an ambient temperature rating for storage of - 40 to + 85 degrees C (- 40 to + 185 degrees F) and shall function continuously in the relative humidity range of 5 percent to 95 percent with no condensation. The PLC system shall be designed and tested to operate in the high electrical noise environment of an industrial plant.
 5. The PLC shall provide a means for mounting the chassis in a standard cabinet.
- C. Central Processors: The CPU shall contain all the relays, timers, counters, number storage registers, shift registers, sequencer, arithmetic capability, and comparators necessary to perform the indicated control functions. It shall be capable of interfacing enough discrete inputs, analog inputs, discrete outputs, and analog outputs as shown on the drawings. The Processor shall be an **Allen Bradley CompactLogix 1769-L30ER** or equal, as shown on the Drawings. The CPU shall be supplied with a 1GB SD card standard. The PLCs shall have the following features and capabilities:
1. All PLCs shall be provided to support and implement closed loop floating and PID control which is directly integrated into the PLC's control program.
 2. The CPU shall be a self-contained unit and shall provide control program execution and support remote or local programming. This device shall also supply I/O scanning and inter-processor and peripheral communication functions.
 3. The operating system shall be contained in removable programmable devices which allow for easy field replacement.
 4. The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" indicator when no fault is detected and a "red" indicator when a fault is detected.
 5. Non-volatile memory shall store the operating system information to protect against loss in the case of power loss or system shut-down. Only at the time of a hardware change shall this configuration status be altered or re-entered.
- D. Program Creation and Storage (Memory)
1. The program storage medium shall be of a static RAM type.

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2. The PLC system shall be capable of addressing up to 2 megabytes, where each word is comprised of 8 data bits.
3. Memory capacity shall be configurable to allow for the most economical match to the intended application. It shall be possible to upgrade to a processor with a larger memory size simply by saving a program, replacing the processor, and downloading the program to the new system without having to make any program changes.
4. Memory shall contain battery back-up capable of retaining all stored program data through a continuous power outage for 4 months under worst case conditions. The capability shall exist to remove all batteries from the system without removing system power. A low battery condition must be detectable in ladder logic but shall not automatically generate a major fault.
5. The operator shall be able to backup volatile memory, including data and program logic, onto external thumb drive, at their option.
6. All user memory in the processor not used for program storage shall be allocable from main memory for the purpose of data storage. The PLC system shall be capable of storing the following data types:
 - a. External Output Status
 - b. External Input Status
 - c. Timer Values
 - d. Counter Values
 - e. Signed Integer Numbers (16-bit)
 - f. Floating Point Numbers
 - g. Decimal Numbers
 - h. Binary Numbers
 - i. BCD Numbers
 - j. Direct and Indexed Addressing
 - k. Internal Processor Status Information
 - l. ASCII Character Data
 - m. ASCII String Data
 - n. Block Transfer Control Structures
 - o. Floating Point PID Control Structures
 - p. File Instruction Control Structures

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- q. Message Control Structures
7. Control logic programs shall have immediate access to the sub-elements of control structures by address and sub-element mnemonic, such as timer accumulator value, timer done bit, or PID Process Variable value.
 8. Each unit shall be supplied with memory to implement the indicated control functions. The memory shall be programmed in a multi-mode configuration with multiple series or parallel contacts, counters, timers, and arithmetic functions.
 9. A standard graphic interface shall be created and displayed on the HMIs for all the system data within the stations. This interface shall include (but are not limited to) pages/tabs for: Overview, data trending, alarm status, pump parameters and settings, wet level set points, instrumentation data, station genset/ATS, temperature, exhaust fan status, etc.. APPENDIX A at the end of this specification includes an example of CBJ's standardized interface page for pumps and level settings and data. Coordinate all graphic interface development with CBJ's SCADA manager for prototype approval. Submit all prototype pages for final approval.
- E. Ethernet Interface and Network
1. The PLC system shall offer industry standard Ethernet TCP/IP communication capabilities. The controller shall be able to connect to industry standard 10baseT media types by implementing a standard RJ-45 transceiver port that can connect to different transceivers. The PLC shall have a selectable option of using 802.32 as the interface to the network as well as DIX Ethernet II. There shall be a software protocol layer that uses TCP/IP as the transport mechanism to deliver packets of data to other PLCs that use the same protocol. This protocol handles the addressing and transfer of all the specific data file types in the PLC to allow for peer-to-peer messaging.
 - a. Token passing system.
 - b. Peer-to-peer communication.
 - c. Message error checking.
 - d. Retries of unacknowledged messages.
 - e. Diagnostic checks on other stations.
 - f. Interface to more than one network.
 - g. A user-oriented command language for manipulation of data structures of variable size and organization, such as setting or resetting bits, word and file transfers in a peer processor.
 - h. The ability to perform PLC memory uploads and downloads.
 - i. The ability to communicate with all other models of PLC manufactured by said manufacturer.

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- j. The ability to monitor the status of any processor remotely via the network.
 - k. The ability to automatically broadcast data to (and receive data from) all compatible stations on the link. Once configured, this operation shall be continuous without operator intervention.
 - l. A gateway interface to the Ethernet TCP/IP network for connectivity to host computers as well as other PLCs that have direct Ethernet connectivity
2. The PLC system shall allow industry standard repeaters, bridges, routers, and gateways on the network in order to access other PLCs and host computers. The controller shall be able to name a specific gateway/router IP address in order to direct data to other networks.
 3. On-line programming and upload/downloads of control programs shall be able to occur over the Ethernet network.
- F. PLC Power Supply
1. The PLC shall operate in compliance with an electrical service of 120 VAC. The PLC power supply shall be mounted in the PLC housing and be sized to power all modules mounted in that housing and an "average module load" for any empty housing slots plus 25 percent above that total. Power supply shall be by the same manufacturer as the PLC and shall be of the same product line. A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Auxiliary power supplies shall provide power to remotely located racks.
 2. The power supply shall be **Allen-Bradley 1769-PA4**, or equal.
- G. PLC Input/Output (I/O) Modules
1. I/O Modules General: All I/O housings and modules shall be suitable for hostile industrial environments. All I/O modules shall be isolated and conform to IEEE Surge Withstand Standards and NEMA Noise Immunity Standards. The I/Os shall be 4-20 mA DC for all analog inputs and outputs and shall be 120 VAC for discrete inputs and dry relay contacts for safe discrete outputs. Each PLC I/O location shall contain the I/O module quantity and type as shown on the Drawings.
 2. Discrete Input Modules with Diagnostics: Defined as contact closure inputs from devices external to the programmable controller module. Individual inputs shall be optically isolated from low energy common mode transients to 1500 volts peak from users wiring or other I/O modules. Input modules shall be **Allen-Bradley 1769-IA16**, or equal.
 3. Discrete Output Modules with Electronic Fuse: Defined as contact closure outputs for ON/OFF operation of devices external to the programmable controller module. The output modules shall be optically isolated from inductively-generated, normal mode and low energy, common mode transients to 1500 volts peak. Discrete output contacts shall be provided with interposing relays in the control panel. Output modules shall be **Allen-Bradley 1769-OA16**, or equal.

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4. Analog Input Modules: Defined as 4 to 20 mA DC signals, where an analog to digital conversion is performed with 14-bit precision and the digital result is entered the processor. The analog to digital conversion shall be updated with each scan of the processor. Input modules shall be source or sink to handle 2-wire or 4-wire transmitters, respectively. Input modules shall be **Allen-Bradley 1769-IF8**, or equal.
- H. PLC Rack Configuration: The PLC, power supply, and I/O modules shall be mounted in the Rack configurations show on the drawings. Space is to be provided for future expansion of the racks in keeping with Allen-Bradley guidelines.
- I. Human Machine Interface (HMI): A color LCD, touch sensitive, the HMI is to be provided to allow local display of data. The unit is to be supplied at 24 VDC and is to communicate to the PLC via an Ethernet interface. The Operator Interface shall be an Industrial PC, Windows 10/11 OS, min. 128GB SSD, i5 Processor, 8GB SO-DIMM DDR4 RAM, **Allen-Bradley Model 6300P, 10"**, or equal. There shall be three HMIs at each station, one local to the SCP and two remote as indicated on the drawings.

2.3 NETWORK HARDWARE

- A. All unshielded twisted pair cabling shall be rated EIA/TIA 568 category 6 for plenum space.
- B. DIN Rail-mounted SMS Access Gateway / Router.
 1. General. UL Listed, industrial design, compact size suitable for DIN Rail mounting, 10Base-T/100Base-TX compliant, Auto sensing full and half duplex, four RJ45 ports. The power supply shall be 12VDC to 24VDC.
 2. Program alarm set-points for Short Message System (SMS) text messages to the Owner. All alarms identified in the Functional Narrative shall be programmed for SMS alarm.

2.4 SPARE PARTS

- A. Provide the following spare parts:

Quantity	Manufacturer	Part No.	Description
1	Allen-Bradley	1769-PA4	120Vac Power Supply
1	Allen-Bradley	1769-IA16	Discrete Input Module
1	Allen-Bradley	1769-IF8	Analog Input Module
1	Allen-Bradley	1769-OA16	Discrete Output Module

PART 3 -- EXECUTION

3.1 GENERAL

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- 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 in order to maintain all instrumentation devices 20 percent within the minimums and maximums of their rated environmental operating ranges. The SI shall provide all power wiring for these devices. Enclosures suitable for the environment shall be provided.
- B. Panel construction shall conform to Article 409 and shall be marked in accordance with paragraph 409.110 of the National Electric Code.
- C. The control panel shall be the source of power for any 120 VAC motor operated or solenoid valves 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.
- D. The control panel shall be either wall-mounted or pedestal-mounted. Internal control components shall be mounted on an internal back-panel or side-panel as required.
- E. Each source of 'external' voltage shall be isolated by providing disconnecting fused terminal blocks or DIN rail mounted relays. The control panel shall be provided with identified terminal strips for the connection of all external conductors. The panel fabricator shall provide enough terminal blocks as shown on the Drawings.
- F. Discrete outputs from the control panels shall be provided by electrically isolated contacts rated for 2 amps at 24 VDC or 10 amps at 120 VAC minimum.
- G. All control panel mounted devices shall be provided as shown on the Drawings.
- H. Fabrication
 - 1. 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. Stiffeners shall be welded to the back of panels, as required to prevent panel deformation due to the weight of face-mounted instruments.
- I. Mounting of Devices
 - 1. The panel vendor shall provide cut-outs and shall mount all devices indicated to be panel-mounted, including any instruments indicated to be furnished by other vendors but installed in the panel.

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2. The panel vendor shall also mount behind the panels other device 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.

J. Electrical Requirements

1. 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.
2. 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.
3. Signal and Control Circuit Wiring
 - a. Pre-wired Assemblies: Digital and analog signal wiring between the PLC I/O modules and the field terminals shall be through pre-wired cable assemblies available from the same manufacturer as the PLC.
 - b. Wire type and sizes: Other control panel conductors shall be flexible stranded copper wire, UL. Wires for instrument signal, alarm and power circuits shall be No. 16 AWG minimum Type MTW rated for 300 volts.
 - c. 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/White 16 AWG minimum
 - 7) DC Positive - Blue 16 AWG minimum
 - 8) DC Negative - White/Blue 16 AWG minimum
 - d. All 120 VAC power wiring protected by the main circuit breaker and incoming power service shall be No. 12 AWG.
 - e. Wire Marking: Wire numbers shall be marked using black numbered wire markers made from heat-shrink plastic. Wires shall be marked as shown on the approved Shop Drawings. Numbers shall read from left to right.
 - f. For equipment grounding, the control panel shall be provided with a 1/4-inch by 1-inch copper ground bus complete with solder-less connector for one No. 4 AWG

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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.

4. 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.
- K. Relays: DIN rail mounted relays shall have contacts rated at 10 amps, 230 volts, at 20,000 operations. The coils shall be 120 VAC at 0.03 amps.
- L. 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-quarter of an ampere rapid blow 250-volt fuse for all analog circuits and all discrete input circuits.
- M. 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
- N. 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** or equal.
- O. Labor and Workmanship: The control panel shall be fabricated and wired by fully qualified workmen who are properly trained, experienced, and supervised.

3.2 MARKING

- A. Control panels shall be marked with the following information that is plainly visible after installation:
1. Manufacturer's name
 2. Supply voltage, number of phases, frequency and full load current.
 3. Short-circuit rating of the main breaker
 4. Name of the project and site

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5. Enclosure rating

3.3 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. The control panel shall be installed, and field tested in accordance with Section 40 90 00 – Process Control and Instrumentation System Commissioning.

3.4 PENETRATIONS

- A. All control panel penetrations shall be bottom entry.

3.5 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. 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.
- D. Shop Drawings shall show conformance to the above wiring installation requirements.
- E. 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 Shop Drawings. These numbers shall be marked on all conductors at every terminal.

3.6 FACTORY TEST

- A. General: Prior to shipment of the WTCP from the factory, but after the procurement, assembly, and configuration of all components, the SI shall conduct a factory test on the panel fabricator shop floor. This test shall be witnessed by a representative of the OWNER and the ENGINEER of record, at the place of fabrication. A minimum of one-week notification shall

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be provided to the ENGINEER prior to testing. The WTCP shall not be shipped without the ENGINEER's written approval of the factory test. The factory test shall demonstrate the functionality and performance of specified features of the PLC.

- B. The SI shall schedule the factory test after receiving approval of the factory test procedures submittal. One test shall be conducted for the complete system. The SI shall provide a qualified technician to assist with testing for the entire duration of the factory test.
- C. 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.
 - 1. All status, control, analog and alarm circuits rung out to determine their operability.
 - 2. All electrical power circuits checked for continuity and where applicable, operability.
 - 3. Any other test required to place the panel in an operating condition.
- D. Test Setup: The complete 'SCP' system as shown on the drawings shall be assembled and interconnected on the panel fabricator's factory floor. The system shall include communication cable segments for the LAN, an Ethernet switch, and an internet connection to simulate as closely as possible the eventual Site installation. The PLC and communication devices shall be loaded with their applicable software packages. PLC input and output modules shall be installed in their assigned housings and wired to field termination points in the enclosures. The SI shall have a complete, up-to-date set of wiring drawings and a PLC register list of all the test points, for review throughout the test. A complete system checklist shall be available during the test for recording results of selected points.
- E. Test Procedure: The factory test shall be conducted in accordance with the previously submitted and approved test procedures. The test procedures shall include written descriptions of how individual tests shall be performed and shall incorporate testing the following features as a minimum.
 - 1. Power Failure: External power to the SCP shall be turned off and back on in order to test the operation of the UPS battery back-up system.
 - 2. Verification of all PLC and system I/O points. Each point shall be checked from the field wiring terminal strip to the I/O module input or output point and to the proper register in the PLC processor.
 - 3. Calibration: All analog inputs and outputs of the PLC shall have their calibration checked at a minimum of two points to verify consistency with the balance of the analog loop. Operator Interfaces and PLC registers shall both be verified for correctness.
 - 4. Verify that the Human-Machine-Interface (HMI) graphics accurately and completely display the water treatment process in accordance with the P&ID drawings and that all process equipment, valve, pump, instrument, etc. tags match the drawings.
 - 5. Verification of proper response and display of all I/O points on the Human-Machine-Interface (HMI) graphical touchscreen. The proper device status or process variable shall be correctly updated on the HMI when the associated I/O point value is changed.

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6. Verify the proper operation of the SMS cellular access gateway/router by logging into the SCP from the SCADA Client PC through the gateway VPN connection. Verify the HMI screens can be viewed and navigated through the gateway.
 7. Verify the alarm text messaging feature of the SMS Network by activating each programmed alarm point and verifying receipt of the appropriate alarm text message.
- F. Test Report: The SI shall record the results of all factory testing on preapproved test forms which the OWNER's and ENGINEER's representatives shall sign. A copy of the completed test forms and a report certifying the results shall be provided to the ENGINEER within 10 days of completing the test.
- G. Rework and Retest: If the SCP does not operate as required, the SI shall make whatever corrections are necessary, and the failed part of the tests shall be repeated. If, in the opinion of ENGINEER's representative, the changes made by the SI for such a correction are enough in kind or scope to effect parts of system operation already tested, then the effected parts shall be retested also. If a reliable determination of the effect of changes made by the SI cannot be made, then the ENGINEER's representative may require that all operations be retested. The SI shall bear all its own costs for the factory test, including any required retesting.

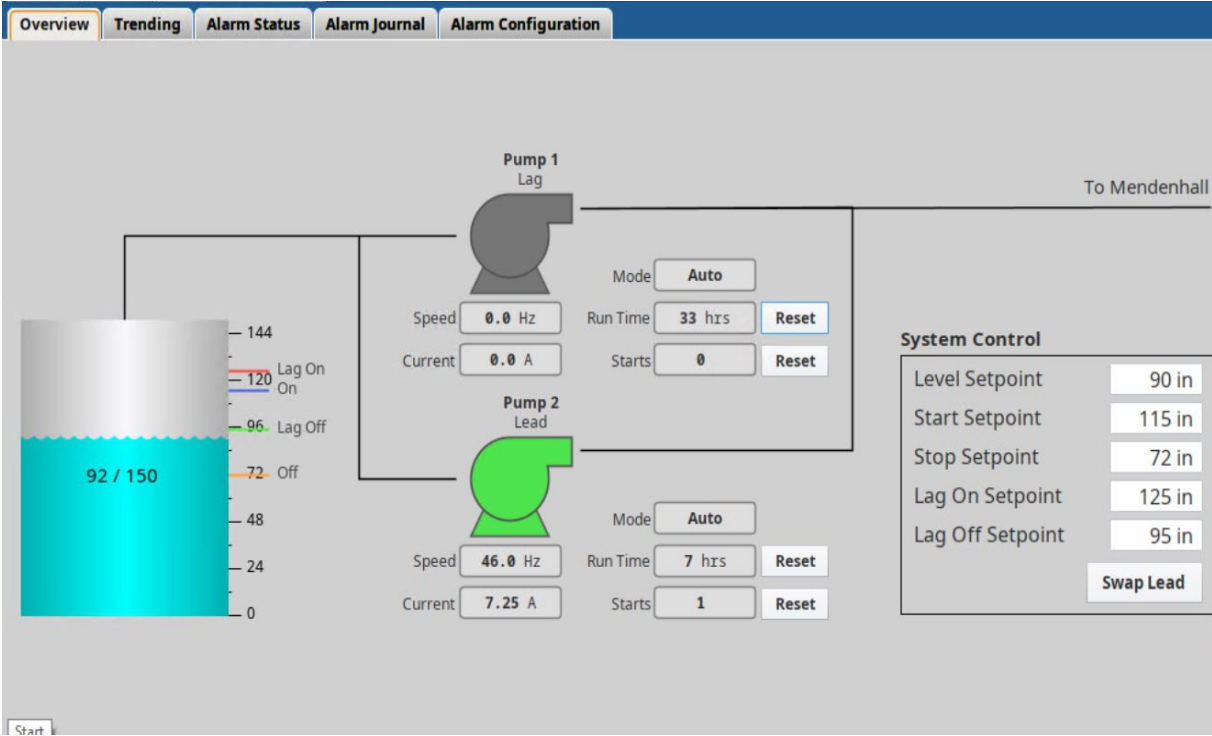
3.7 FIELD CALIBRATION, TESTING, AND INSTRUCTION

- A. General: The SCP shall be tested again for functional operation in the field after the connection of external conductors and prior to equipment startup. Field calibration, testing, and instruction shall be performed in accordance with Section 40 61 00 – Process Control and Instrumentation Systems Commissioning.

END OF SECTION

APPENDIX A – Sample HMI Interface Graphic

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Alarm Configuration		
<input type="radio"/> Analog <input checked="" type="radio"/> Discrete		
Lemon A Generator Running	Enabled	Delay 0 Sec
High Level Float	Enabled	Delay 0 Sec
Pump 1 Fault	Enabled	Delay 0 Sec
Pump 1 High Temperature	Disabled	Delay 0 Sec
Pump 1 Seal Leakage	Disabled	Delay 0 Sec
Pump 2 Fault	Enabled	Delay 0 Sec
Pump 2 High Temperature	Disabled	Delay 0 Sec
Pump 2 Seal Leakage	Disabled	Delay 0 Sec
Pumps Not In Auto	Enabled	Delay 0 Sec

SECTION 40 71 00 – IN-LINE LIQUID FLOW MEASURING SYSTEMS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. General: The CONTRACTOR shall provide in-line liquid flow measuring systems, 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.
- C. All parts and components shall be of a single manufacturer and designed as a single system.
- D. All instruments shall be FM-approved, or equal.

1.2 SUBMITTALS

- A. General: Shop Drawings shall be submitted in conformance with the requirements of Section 40 90 00 – Process Control and Instrumentation Systems.
- B. General:
 - 1. Submittals shall be furnished for the purpose of evaluating bids.
 - 2. Shop Drawings, Owner's Manual, and Record Drawings shall be submitted in conformance with the requirements of Section 40 90 00 – Process Control and Instrumentation Systems.
- C. Shop Drawings: Provide detail drawings of the metering body (i.e.: flow tube) for the purpose of verifying sizes, fit and application.
- D. Technical Data: Provide data sheets along with operations and maintenance manuals for bid evaluation purposes.
- E. Startup Services: The system manufacturer shall be locally represented having a factory-certified factory-trained service technician. The representative's technician shall provide startup services once the owner has installed the equipment. Technician credentials are to be submitted with this bid.
 - 1. These instruments will be installed at separate locations in the Anchorage area resulting in a service trip for each installation.
 - 2. Startup services are to include installation verification, commissioning, calibration and 1 hour of informal training.

SECTION 40 71 00 – IN-LINE LIQUID FLOW MEASURING SYSTEMS

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Magnetic flow meter:
 - 1. **Endress + Hauser Promag W400, 5W4C3H, DNXXX 10”**
 - 2. **Endress + Hauser Promag W400, 5W4C3H, DNXXX 8”**
- B. Flow switch:
 - 1. **McDonnell Miller FS7-4**
 - 2. Or equal

2.2 MAGNETIC FLOW METER

- A. General:
 - 1. The electromagnetic flow meters shall be comprised of a flow tube and a converter. The flow tube shall generate a measuring signal proportional to the velocity in the pipe. The converter shall convert the measuring signal into a standard 4-20 mA current output, proportional to the flow rate. The flow meter shall operate by means of pulsed DC coil excitation.
 - 2. Flow tube and Transmitter
 - 3. System accuracy shall be better than 0.5 percent of flow rate for velocities greater than 1.5 fps.
 - 4. The flow meter shall be suitable for velocity range of 1.5 to 30 fps
 - 5. Provide flow meters with enclosures suitable for the environment and in accordance with the hazardous location diagram. Minimum rating shall be NEMA 4X.
 - 6. Provide flow tube diameters in accordance with the following schedule:

Tag No.	Location	Flow Tube Diameter
FT- 201	Outer Drive Station	10”
FT- 201	West Juneau Station	8”

- B. Flow tube:
 - 1. Materials of Construction
 - a. Flow tube: 304 stainless steel lined with vulcanized rubber.
 - a. Electrodes Hastelloy C.
 - 2. Flow tubes shall have 150-pound ANSI B16.5 flange connections for meters up to 24-inches in size and AWWA C115 flanges for meters greater than or equal to 28-inches.

SECTION 40 71 00 – IN-LINE LIQUID FLOW MEASURING SYSTEMS

3. Flow tubes shall be provided with grounding rings
4. Flow tubes shall be IP 68 rated to provide protection for continuous submergence.
5. The flow meter shall be suitable for operation at temperatures from 0° C to 80° C.

C. Transmitter:

1. The transmitter shall provide a 4-20 mA signal proportional to flow with adjustable damping. Provide a pulse output for flow totalization.
2. Power supply shall be 120VAC, 60 Hz.
3. Transmitter shall be located per the Drawings

2.3 FLOW SWITCH

- A. The flow switch shall be a paddle-type flow switch. The flow switch shall actuate a contact once a minimum flow is detected.
- B. Materials of Construction:
 1. Brass, stainless steel, PTFE.
 2. NEMA 4X enclosure.
- C. The flow switch shall have the following:
 1. Range shall be 4.8-998gpm adjustable.
 2. Maximum pressure shall be 300psi or greater.
 3. Maximum temperature shall be 300°F.
 4. Two SPDP switches rated at 7.4A at 120V.

PART 3 - EXECUTION

3.1 GENERAL

- A. Flow measuring systems shall be handled, installed in accordance with the Manufacturers installation instructions and calibrated, loop-tested, precommissioned, and performance tested by authorized manufacturer's representatives according to Section 40 90 00 – Process Control and Instrumentation Systems.
- B. The Manufacturer shall provide 4 hours of on-site training for each type of instrument.
- C. The CONTRACTOR shall cut, patch, fit, and weld fittings to existing pipes as necessary. Pipes shall be cleaned and painted to match existing pipe finish. All fittings and fixtures shall be disinfected following the standard procedure before being put into service.

END OF SECTION

SECTION 40 71 00 – IN-LINE LIQUID FLOW MEASURING SYSTEMS

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SECTION 40 72 00 – LEVEL MEASURING SYSTEMS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. General: The CONTRACTOR shall provide level measuring systems, 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.
- C. All instruments shall be FM-approved, or equal.

1.2 SUBMITTALS

- A. Furnish submittals in accordance with Section 40 90 00 – Process Control and Instrumentation Systems.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The CONTRACTOR shall provide the instrumentation and auxiliary devices to satisfy the functional requirements in the relevant mechanical equipment and Instrumentation & Control specifications and the Electrical Schematics. Equipment shall be fabricated with UL-labeled components. Stations not specifically indicated as being WORK of other Sections shall be provided under this Section. All equipment shall be wired under this Section.
- B. The controls shall be 120-volt maximum, preferably 24 VDC. Where the electrical power Control conductors shall be provided in accordance with Section 26 05 00 – Electrical Work, General.
- C. Each device shall be provided with identified terminal strips for the connection of external conductors. The CONTRACTOR shall provide sufficient terminal blocks to connect 25 percent additional conductors for future use. Termination points shall be identified in accordance with Shop Drawings. All equipment associated with the stations shall be ready for service after connection of conductors to equipment, controls, and stations.
- D. Enclosures
 - 1. Enclosures in hazardous locations shall be rated for that area. Classification rating shall be clearly identified.
 - 2. Wet wells are a Class 1, Division 1 hazardous location.

2.2 RADAR LEVEL TRANSDUCER

- A. A radar level transmitter shall be provided to sense liquid level of the wet wells as shown on the drawings and in accordance with the manufacturer's recommendations.

SECTION 40 72 00 – LEVEL MEASURING SYSTEMS

- B. The Frequency Modulated Continuous Wave radar transmitter used primarily for liquid and slurry applications, which shall operate at 80 GHz using 2-wire technology for level measurement and provide a 4-20 mA HART output.
- C. The unit shall be suitable for use in safety related systems (overspill protection) with requirements for functional safety up to SIL2 (SIL3 in homogenous redundancy) independently assessed by TUV in accordance to IEC 61508/IEC 61511-1.
- D. The transmitter housing shall have dual compartments and be available in plastic, die cast aluminum with a powder Epoxy coating or 316L Stainless steel based on the application environment.
- E. Unit shall employ multi echo tracking algorithms for reliable level measurement and shall not be affected by changing media, changing temperatures, gas blankets or vapors. The transmitter shall measure almost completely independent from product properties. The transmitter will contain a gas tight feed through to prevent process from intruding into the housing from the process vessel when required.
- F. The transmitter will have a 4 line LCD display, which can be remote mounted if required. All programming and set-up can be done by the three buttons on the display. The unit will have the capability of mapping out any object that causes an interference the in the radar reflections. FDT based software shall be provided for optional remote method of configuration, set-up and storage of parameters via a computer. The display module shall be capable of data backup, data comparison and data transfer functions. It must be possible to view a graphical representation of the actual signal and envelope curve on the display.
- G. The transmitter will have a 32 point linearizer to correct output to represent volume measurement or use as a strapping table for level correction.
- H. The unit shall have a measuring range up to 262 ft (80 m)
- I. The unit shall be suitable for process temperatures up to 392° F (200° C). It shall also withstand pressures of -14.5 to 362.6 psi.
- J. The transmitter shall have a built-in HistoRom which will store the configuration data and be capable of logging 20 events based on programmed triggers.
- K. The transmitter will incorporate internal advanced diagnostics allowing the use of a DTM based program using Heartbeat™ technology. Verification will provide in-situ testing and simulation and a final printable report documentation.
- L. The transmitter will be capable of producing a beam angle as small as 3 degrees.
- M. Radar Level Transducer shall be **Endress + Hauser – Micropilot FMR60**.
- N. Provide the following devices:

Tag No.	Location
LT- 401	Outer Drive - Wet Well
LT- 401	West Juneau - Wet Well

SECTION 40 72 00 – LEVEL MEASURING SYSTEMS

2.3 SUBMERSIBLE LEVEL PROBE

- A. A submersible level probe shall be provided to act as a backup liquid level sensor for the wet wells as shown on the Drawings and in accordance with the manufacturer’s recommendations. Provide all necessary support cables and stainless-steel hardware for hanging the probe within the wet well per manufacturer’s requirements.
- B. The probe shall connect to the pump control system through an Intrinsically Safe (IS) barrier. The probe levels shall be detected when the wet well liquid level touches an electrode on the conductance probe body.
- C. The probe electrode material shall be stainless steel. The level probe casing material shall be PVC. Both the inner and outer jackets for the level probe cable shall be PVC. The inner jacketed wire shall be tinned copper, 18 AWG, and the individual conductors shall be numbered. The outer casing for the conductor cables shall be blue.
- D. There shall be strain relief where the cable enters the probe and at the point where the cable is hung from a stainless-steel, wall mounted support bracket that will allow for periodic self-cleaning with the probe is raised through the bracket.
- E. Input/Output Signal: 10-30 VDC.
- F. Approvals: UL Listed 508, Intrinsically safe for Class 1, Groups A, B, C, D, Class 2, E, F, G; when installed with a listed IC barrier.
- G. Probe shall have a min. of ten (10) conductive electrodes to accommodate the level measurement requirements.
- H. Probe shall be supplied with stainless steel, wall mounted, cleaning bracket. Bracket shall allow the probe to be cleaned along it’s length as it’s removed from the wet well.
- I. Level probe shall be **Flygt / Xylem** or approved equal.
- J. Provide the following devices:

Tag No.	Location
LT - 402A,B,C,D,E	Outer Drive - Wet Well
LT - 402A,B,C,D,E	West Juneau - Wet Well

2.4 LEVEL FLOATS

- A. Wetted Parts: Body shall be polypropylene, EPDM rubber.
- B. Cable: Special compound PVC or NBR/PVC Nitrile rubber. Length as required for installation.
- C. Rating: 30VDC, 5A

SECTION 40 72 00 – LEVEL MEASURING SYSTEMS

- D. Approvals: CSA, Class 1, Div. 1 Groups A, B, C, D.
- E. Floats shall be **Flygt Model #ENM-10**, or approved equal.
- F. Provide the following devices:

Tag No.	Location
LAHH – 421	Outer Drive - Wet Well
LAHH - 421	West Juneau - Wet Well

PART 3 - EXECUTION

3.1 GENERAL

- A. Level measuring systems shall be handled, installed, calibrated, loop-tested, precommissioned, and performance tested according to Section 40.90.00 – Process Control and Instrumentation Systems.

3.2 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 locations 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. Verify set-up and configuration of all instruments in accordance with the Manufacturer’s instructions.
- C. 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 26.
- D. Instrumentation Tie-Downs: Instruments, control panels, and equipment shall be anchored by methods that comply with seismic requirements applicable to the Site.

SECTION 40 72 00 – LEVEL MEASURING SYSTEMS

- E. Existing Instrumentation: Each Existing instrument to be removed and reinstalled shall be cleaned, reconditioned, and recalibrated by an authorized service facility of the instrument manufacturer. The CONTRACTOR shall provide certification of this work prior to reinstallation of each instrument.
- F. 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.
- G. 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. Connections shall be, as 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. Mounting stands and bracket materials and workmanship shall only comply with requirements of the Contract Documents.
 - 10. Verify the correctness of each installation, including polarity of electrical 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.
 - 11. The OWNER will not be responsible for any additional cost of rework attributable to actions of the CONTRACTOR or the PANEL FABRICATOR.

3.3 CALIBRATION

- 1. General: Devices provided under Division 40 shall be calibrated according to the manufacturers' recommended procedure to verify operational readiness and ability to meet the indicated functional and tolerance requirements.
- 2. Field Calibration: Instruments that were not bench-calibrated shall be calibrated in the field to ensure proper operation in accordance with the instrument loop diagrams or specification data sheets.

SECTION 40 72 00 – LEVEL MEASURING SYSTEMS

3.4 LOOP TESTING

- A. The CONTRACTOR shall coordinate with and assist the PANEL FABRICATOR and to complete the various control panel loop testing.
- 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 controller. Actual signals shall be used wherever available. Following any necessary corrections, the loops shall be retested.

3.5 PERFORMANCE TEST

- A. The CONTRACTOR shall assist and coordinate with the PANEL FABRICATOR during the complete start-up, testing and commissioning process. The CONTRACTOR shall provide proper qualified personnel to make adjustments, assist with troubleshooting, provide technical support, etc. as necessary during the commissioning process.
- B. The entire PCIS hardware, field instruments, power supplies, and wiring shall operate for 30 days without failure.
- C. The CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.
- D. 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.

3.6 FINAL ACCEPTANCE TEST

- A. Once all equipment and subsystem tests have been complete and results accepted by the ENGINEER, the complete PCIS system shall be put into service for a Final Acceptance Test. The OWNER and ENGINEER shall be notified a minimum of 48 hours prior to the start of the test.
- B. The entire PCIS system control panels hardware, field instruments, power supplies, and wiring shall operate in accordance with the Specifications and Functional Narrative for 30 days without failure.
- C. If any component, other than field instruments, fails during the final acceptance test, it shall be repaired or replaced and the PCIS shall be restarted for another 30-day period.

SECTION 40 72 00 – LEVEL MEASURING SYSTEMS

- D. The CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.

3.7 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

- A. For the purpose of this Section, the following 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 the 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 72 00 – LEVEL MEASURING SYSTEMS

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SECTION 40 73 00 – PRESSURE MEASURING SYSTEMS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. General: The CONTRACTOR shall provide pressure measuring systems, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 90 00 – Process Control and Instrumentation Systems apply to the WORK of this Section.
- C. All instruments shall be FM-approved, or equal.

1.2 SUBMITTALS

- A. General: Shop Drawings, Owner's Manual, and Record Drawings shall be submitted in conformance with the requirements of Section 40 90 00 – Process Control and Instrumentation Systems.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Electrical interface and code compliance shall conform to the requirements of Section 40 90 00 – Process Control and Instrumentation Systems.

2.2 ELECTRONIC PRESSURE TRANSMITTERS

- A. Components: Electronic gauge and differential pressure transmitters shall consist of a capsule assembly, process connector and connection, amplifier unit, integral indicator, terminal box with cover, block and bleed valves, and conduit connections. Process connection shall be 1/2" NPT. Each transmitter installation shall include a manifold system and gauge as shown on the drawings. Process sensing lines shall be 1/4-inch stainless steel tubing.
- B. Operation: Pressure applied to the unit shall be transmitted to a sensing diaphragm made of ceramic sensor or polysilicone. Performance Requirements are:
 - 1. The amplifier unit shall convert the change in capacitance to a 4-20 mA DC signal, 2-wire type, with an allowable loop load of no less than 600 ohms.
 - 2. Static pressure rating shall be a minimum of 600 psig.
 - 3. The maximum over range pressure limit shall be a minimum of 150 percent of the minimum range.
 - 4. Span shall be adjustable over a minimum of 5:1 range.
 - 5. Damping shall be provided as an internal adjustment.
 - 6. All equipment shall be suitable for an ambient operating range of minus 40 degrees F to plus 100 degrees F.
 - 7. Integral indicators shall be calibrated in process units.

SECTION 40 73 00 – PRESSURE MEASURING SYSTEMS

- 8. Power supply shall be 24 VDC, loop powered.
- 9. Accuracy, including linearity and repeatability, shall be a plus or minus 0.2 percent of span.
- 10. Any solution in the probe shall be food grade.

- C. Materials: All wetted parts shall be constructed of 316 stainless steel. Exposed parts shall be stainless steel or aluminum with polyurethane coating.
- D. The devices shall be smart devices that can be calibrated with a Fluke 744 HART protocol calibrator.
- E. Pressure transmitter housing shall be rated for NEMA 4X.
- F. Manufacturer’s Gauge Pressure Transmitters: **Rosemount Model 2088**, or equal.

The following electronic gauge pressure transmitters shall be provided:

Tag No.	Location	Range (psig)	Process Connection
PT-101	Outer Drive	Up to 4,000	
PT-102	Outer Drive	Up to 4,000	
PT-103	Outer Drive	Up to 4,000	
PT-201	West Juneau	Up to 4,000	
PT-202	West Juneau	Up to 4,000	

PART 3 - EXECUTION

3.1 GENERAL

- A. Pressure measuring and control systems shall be handled, installed, calibrated, loop-tested, pre-commissioned, and performance tested according to Section 40 90 00 – Process Control and Instrumentation Systems.
- B. Mounting hardware and sensing lines shall be stainless steel in accordance with Section 22 11 19 – Piping and Tubing Systems.
- C. 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 locations 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.

SECTION 40 73 00 – PRESSURE MEASURING SYSTEMS

- D. 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 26.
- E. Instrumentation Tie-Downs: Instruments, control panels, and equipment shall be anchored by methods that comply with seismic requirements applicable to the Site.
- F. Existing Instrumentation: Each Existing instrument to be removed and reinstalled shall be cleaned, reconditioned, and recalibrated by an authorized service facility of the instrument manufacturer. The CONTRACTOR shall provide certification of this work prior to reinstallation of each instrument.
- G. 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.
- H. 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. Connections shall be, as 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. Mounting stands and bracket materials and workmanship shall only comply with requirements of the Contract Documents.
 10. Verify the correctness of each installation, including polarity of electrical 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.
 11. The OWNER will not be responsible for any additional cost of rework attributable to actions of the CONTRACTOR or the PANEL FABRICATOR.

SECTION 40 73 00 – PRESSURE MEASURING SYSTEMS

3.2 CALIBRATION

1. General: Devices provided under Division 40 shall be calibrated according to the manufacturers' recommended procedure to verify operational readiness and ability to meet the indicated functional and tolerance requirements.
2. Field Calibration: Instruments that were not bench-calibrated shall be calibrated in the field to ensure proper operation in accordance with the instrument loop diagrams or specification data sheets.

3.3 LOOP TESTING

- A. The CONTRACTOR shall coordinate with and assist the PANEL FABRICATOR and to complete the various control panel loop testing.
- 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 controller. Actual signals shall be used wherever available. Following any necessary corrections, the loops shall be retested.

3.4 PERFORMANCE TEST

- A. The CONTRACTOR shall assist and coordinate with the PANEL FABRICATOR during the complete start-up, testing and commissioning process. The CONTRACTOR shall provide proper qualified personnel to make adjustments, assist with troubleshooting, provide technical support, etc. as necessary during the commissioning process.
- B. The entire PCIS hardware, field instruments, power supplies, and wiring shall operate for 30 days without failure.
- C. The CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.
- D. 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 FINAL ACCEPTANCE TEST

- A. Once all equipment and subsystem tests have been complete and results accepted by the ENGINEER, the complete PCIS system shall be put into service for a Final Acceptance Test.

SECTION 40 73 00 – PRESSURE MEASURING SYSTEMS

The OWNER and ENGINEER shall be notified a minimum of 48 hours prior to the start of the test.

- B. The entire PCIS system control panels hardware, field instruments, power supplies, and wiring shall operate in accordance with the Specifications and Functional Narrative for 30 days without failure.
- C. If any component, other than field instruments, fails during the final acceptance test, it shall be repaired or replaced and the PCIS shall be restarted for another 30-day period.
- D. The CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.

3.6 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

- A. For the purpose of this Section, the following 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 the 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 73 00 – PRESSURE MEASURING SYSTEMS

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SECTION 40 74 00 – pH and TEMPERATURE MEASURING SYSTEMS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. General: The CONTRACTOR shall provide pH and Temperature measuring systems, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 90 00 – Process Control and Instrumentation Systems apply to the WORK of this Section.
- C. A single or dual channel water quality sensor transmitter with a local user interface AND the ability to access sensor data remotely through a browser enabled device.
- D. Provide labor, material, equipment, related services, and supervision to install and operate the controller to drawings and manufacturer’s specifications.

1.2 SYSTEM DESCRIPTION

- A. Design requirements
 - 1. Includes capability to actively monitor all internal components and present diagnostics on the overall health of connected sensors and time to next required maintenance, reducing user risk.
 - a. Ability to see and be notified of upcoming and past due maintenance.
 - 2. Includes capability to provide real-time alerts when sensor issues occur with built in workflows with step-by-step guidance to perform calibration and maintenance tasks, reducing user risk.
 - 3. Includes ability for a Wi-Fi connection OR a LAN connection.
 - 4. Supports advanced communication protocols, including Profibus DPV1, Modbus TCP/IP, Modbus, Profinet IO, and Ethernet IP.
 - 5. Provides capability to view all connected plant measurements, alerts, calibration, and maintenance status in real time on any internet browser capable device.
 - 6. Controller designed to be used in indoor or outdoor locations.
- B. Performance Requirements
 - 1. The controller accepts digital sensors in any combination to measure the following water quality parameters:
 - a. pH/ORP
 - b. Conductivity
 - c. Temperature

SECTION 40 74 00 – pH and TEMPERATURE MEASURING SYSTEMS

C. Environmental Requirements

1. Operational Criteria

- a. Operating Temperature:
 - 1) Ethernet version: –20 to 45 °C (–4 to 113 °F)
 - 2) Wi-Fi version including Controller and external Wi-Fi USB BOX: -20 to 60 °C (- 4 to 140 °F)
- b. Storage temperature: –20 to 70 °C (–4 to 158 °F)
- c. Relative humidity: 0 to 95%, non-condensing
- d. Altitude ≤2000m (6,562 ft.)

1.3 CERTIFICATIONS

- A. EMC: CE approved (with all sensor types). Listed for use in general locations to UL and CSA safety standards by ETL (with all sensor types).
- B. Safety: General Purpose UL/CSA 61010-1 with cETLus safety mark
- C. Possibility for Hazardous Locations Use: Class 1 Div 2

1.4 WARRANTY

- A. Warranted for 1 year from date of shipment from manufacturer defects.

1.5 SUBMITTALS

- A. General: Shop Drawings, Owner's Manual, and Record Drawings shall be submitted in conformance with the requirements of Section 40 90 00 – Process Control and Instrumentation Systems, and Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. **Hach Company**
 1. **SC4500 Controller, sensor and required cables**
 2. **Insertion Mount Hardware Kit – MH116M3MZ**

2.2 MANUFACTURED UNIT

- A. Microprocessor-based sensor controller.
- B. Change digital sensors connected to the controller by unplugging and plugging in sensors as necessary.

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- C. The controller shall be available with the following power requirements:
AC powered: 100–240 VAC \pm 10%, 50/60 Hz; 1 A (28 W sensor load)
DC powered: 24 VDC +15% –20%; 2.5 A (20 W sensor load)
- D. The controller uses a menu-driven operation system.
- E. The controller is equipped with a real-time clock.
- F. The controller is equipped with two security levels.
- G. The controller shall have worded operation menus in 24 languages.
- H. The controller is equipped with an USB reader for data download and controller software upload.
- I. Voltage:
Two relays (SPDT);
Wire gauge: 0.75 to 1.5 mm² (18 to 16 AWG)
- AC controller
Maximum switching voltage: 100–240 VAC
Maximum switching current: 5 A Resistive/1 A Pilot Duty
Maximum switching power: 1200 VA Resistive/360 VA Pilot Duty
- DC controller
Maximum switching voltage: 30 VAC or 42 VDC
Maximum switching current: 4 A Resistive/1 A Pilot Duty
Maximum switching power: 125 W Resistive/28 W Pilot Duty
- J. Five analogs 0/4-20 mA outputs are provided with a maximum impedance of 500 ohms.
1. The controller can be equipped with five 4-20 mA outputs with a maximum impedance of 500 ohms.
 2. The following can be programmed:
 - a. Alarms:
 - 1) High and Low alarm point
 - 2) High and Low alarm point deadband
 - 3) On and Off delay
 - b. Controls
 - 1) Linear
 - 2) PID
- K. The controller can be equipped with the following forms of communication:
1. Profibus DP
 2. Modbus TCP/IP
 3. Profinet (ODVA certified)
 4. Ethernet IP (ODVA certified)
- L. All user settings of the controller are retained for 10 years in flash memory.

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- M. The controller is equipped with a system check for:
 - 1. Motherboard temperature
 - 2. Field auto-test

2.3 EQUIPMENT

- A. Materials
 - 1. Housing: polycarbonate, aluminum (powder coated), and stainless steel Metal enclosure with a corrosion-resistant finish
 - 2. Rating: UL50E type 4X, IEC/EN 60529–IP 66, NEMA 250 type 4X
- B. Conduit openings: 0.5 in. NPT

2.4 COMPONENTS

- A. To deliver:
 - 1. Controller as described in section 1.1.A
 - 2. Mounting hardware for wall, pipe, and panel mounting
 - 3. User manual and installation documentation
- B. Dimensions: Refer to controller drawings
- C. Weight: 1.7 kg (3.7 lbs.)
- D. Electrical interface and code compliance shall conform to the requirements of Section 40 90 00 – Process Control and Instrumentation Systems.

PART 3 - EXECUTION

3.1 GENERAL

- A. Pressure measuring and control systems shall be handled, installed, calibrated, loop-tested, pre-commissioned, and performance tested according to Section 40 90 00 – Process Control and Instrumentation Systems.

3.2 PREPARATION

- A. Mounting
 - 1. Mount the controller as shown on the drawings
 - 2. Insertion type sensor should be mounted in accordance with the manufacturer's requirements.

3.3 INSTALLATION

- A. Install controller following transmittal drawings and instrument user manual.

SECTION 40 74 00 – pH and TEMPERATURE MEASURING SYSTEMS

3.4 MANUFACTURER’S SERVICE AND START-UP

- A. Contractor will include manufacturer’s services to perform commissioning of the system to include device provisioning to communicate via local protocols and initiate initial product configuration
- B. Contractor will include the manufacturer’s services to perform start-up on instrument to include basic operational training and certification of performance of the instrument.
- C. Contractor will include a manufacturer’s Service Agreement that covers all the manufacturer’s recommended preventative maintenance, regularly scheduled calibration and any necessary repairs beginning from the time of equipment startup through to end user acceptance / plant turnover and the first 12 months of end-user operation post turnover.
- D. Items A and B are to be performed by manufacturer’s factory-trained service personnel. Field service and factory repair by personnel not employed by the manufacturer is not allowed.
- E. Use of manufacturer’s service parts and reagents is required. Third-party parts and reagents are not approved for use.

END OF SECTION

SECTION 40 74 00 – pH and TEMPERATURE MEASURING SYSTEMS

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SECTION 40 75 00 – GAS DETECTORS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. General: The CONTRACTOR shall provide pressure measuring systems, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 90 00 – Process Control and Instrumentation Systems apply to the WORK of this Section.
- C. All instruments shall be FM-approved, or equal.

1.2 SUBMITTALS

- A. In accordance with the requirements of Section 01300, submit the following Project Data:
 - 1. Descriptive literature bulletins, and catalog cuts of the equipment.
 - 2. Materials of construction.
 - 3. Complete wiring diagrams.
 - 4. Complete installation instructions, with points of electrical connection requirements clearly shown.

1.3 QUALITY ASSURANCE

- A. Manufacturer Capability Requirements - As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements:
 - 1. The manufacturer must be capable of supplying all equipment used to check or calibrate the sensor/transmitter units.
 - 2. The manufacturer must be capable of providing on-site service with factory trained personnel.
 - 3. The manufacturer must be capable of providing on-site training for owner/operator.
 - 4. Equipment shall be of the latest approved designs manufactured by a nationally recognized manufacturer and in conformity with the governing NEMA standards.
- B. Approvals: Detectors shall be UL listed and be rated for Class I, Division 1, Groups C&D hazardous locations.

1.4 WARRANTY

- A. The IR source in the infrared sensor will have a minimum useful life of ten (10) years. The supplier will provide replacement sensors at no charge for any sensor that does not meet the minimum requirement.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER'S

SECTION 40 75 00 – GAS DETECTORS

- A. MSA Ultima XIR Series
- B. Or equal.

2.2 INFRARED COMBUSTIBLE GAS SENSOR/TRANSMITTER

- A. Gas sensor/transmitter shall be capable of detecting combustible gases including methane, petroleum vapors and propane from 0-100% LEL levels.
- B. Sensor/transmitter enclosure shall be 316 stainless steel explosion-proof.
- C. The infrared (IR) combustible sensor must be capable of calibration without gas. The sensor/transmitter must be capable of performing a full calibration by zero adjustment only.
- D. The IR sensor/transmitter shall detect for an above 100% LEL condition (over-range). This condition must be indicated on the front panel LCD.
- E. The IR sensor/transmitter shall not contain a flashback arrestor / frit.
- F. The IR sensor/transmitter must allow for a gas check without alternate calibration / gas check fittings or cap.
- G. Operating Voltage - The sensor/transmitter shall operate between 8-30 VDC loop power.
- H. Sensor/transmitter electronics shall consist of one PCB. This PCB shall offer expandability to allow for optional LED's and relays.
- I. The single PCB shall not require tools for installation or removal.
- J. The single PCB must be self-aligning in the enclosure.
- K. Sensor/transmitter shall allow for optional reset connector for resetting latched alarms.
- L. Set-up and start-up of the sensor/transmitter will be so that the enclosure need not be opened during this process.
- M. Sensor/transmitter shall be factory calibrated, ready for use out of the box. A gas check is all that is required to ensure proper operation.
- N. Sensor/transmitter shall contain no pots, jumpers or switches.
- O. Sensor/transmitter output signal shall be 4 to 20mA.
- P. Sensor/transmitter shall have optional relays. Relays shall be rated at 5 amps @ 30VDC, 5 amps @ 220VAC, single-pole, double-throw and consist of three for alarm levels and one for fault. All relay contact activation will be monitored. If the relay cannot activate for any reason, the trouble relay will change state. All relays shall be field selectable through a non-intrusive hand-held wireless remote

SECTION 40 75 00 – GAS DETECTORS

control unit (Controller) or a HART hand held communicator. Selectable features include:

1. Alarm level
 2. Latching / Non-latching
 3. Upscale / Downscale
 4. Normally-opened / Normally-closed
 5. Energized / De-energized
- Q. Sensor/transmitter shall allow for full range scaling of the 4-20mA-output signal.
- R. Sensor/transmitter will be capable of storing and displaying average, minimum and maximum gas concentrations over selected periods of time.
- S. The sensor/transmitter will give an indication of when sensor is nearing the end of its useful life by means of the front panel LCD. This indication that the sensor is nearing its useful life will be based on the sensor output. It shall not be based on the time the sensor was in service.
- T. The sensor/transmitter units can be located remote from a monitor/readout unit by up to 4000 feet via properly gauge wire.
- U. Sensor/Transmitter Remote Sensor Mounting:
1. The sensor portion of the sensor/transmitter unit will be capable of being able to be remotely mounted from the electronics and display. The separate sensor enclosure will be able to be mounted up to one hundred (100) feet from the main enclosure.
 2. The sensor housing for the explosion-proof Gas Monitor will be in an enclosure suitable for location in Class I, Division 1, Groups A, B, C & D, Class II, Division 1, Groups E & F, Class III classified areas.
 3. A two twisted pair cable will connect the sensor housing and the calibration electronics.
 4. The readout portion of the sensor/transmitter shall have a display of the concentration of gas present. The display will be visible from a minimum of 5 feet and will be present at all times. It will not be required to be turned on or off. This readout will be three, one half inch digit Liquid Crystal Displays (LCD).

2.3 SENSOR/TRANSMITTER DISPLAY

- A. There will be a local display indicating the gas type being monitored and the concentration of gas present. The display will alternate between the gas type (1 second) and gas concentration (5 seconds). The display will be an integral part of the sensor/transmitter enclosure. The display will be visible from a minimum of 5 feet and will be present always, and will not require being turned on or off. This readout will be three, one half-inch (3 1/2") digit Liquid Crystal Displays (LCD).
- B. Sensor/transmitter display shall indicate all diagnostic check/fault conditions with a scrolling message detailing the condition. Error codes shall not be used.

SECTION 40 75 00 – GAS DETECTORS

- C. Sensor/transmitter will display 3 levels of alarm. Alarm levels will be adjustable by means of a hand held infrared controller or a HART hand held communicator.
- D. Sensor/transmitter shall have optional LED's, viewable from 50 feet, minimum. The LED's shall operate as follows:
 - 1. Solid green LED – normal operation (measure mode)
 - 2. Solid red LED – fault condition
 - 3. Blinking red LED – alarm condition

2.4 MANUFACTURER

- A. The following sensor/transmitters shall be a **MSA Ultima XIR Series Gas Monitor Sensor/Transmitter model # A-ULTIMA X-XP-E-32-U-1-S-2-0-0-1-3-1-1-0** or equal.

TAG NO.	LOCATION
LEL - 251	Outer Drive - Ground level
LEL - 252	Outer Drive - Pump level
LEL - 251	West Juneau -Ground level
LEL - 252	West Juneau - Pump level

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Gas sensors/transmitters shall be installed where shown on the drawings. Provide all mounting brackets, hardware, wiring, junction boxes, etc. as required for a complete and functioning system.
- B. Install per manufacturer's recommendations and instructions. A mounting strap shall be used which mounts the sensor/transmitter to a wall or similar structure.
- C. The mounting strap shall attach to the sensor/transmitter via two tapped and threaded holes on the rear of the sensor/transmitter. There shall be no brackets or clamps to secure this strap to the sensor/transmitter.
- D. Provide PE tubing between the transmitter and sensor in accordance with manufacturer's recommendations to facilitate calibration from ground level.
- E. The Integrator shall be responsible for coordinating the installation of each instrument with the Contractor. This shall include installation of the instrumentation, mounting hardware, and ancillary equipment. The instrumentation shall be physically installed by the Contractor or, at the option of the Contractor, by the Integrator in accordance with the installation drawings.

SECTION 40 75 00 – GAS DETECTORS

- F. Installation shall include all sensors and transmitters and all interconnecting wiring between all sensors, transmitters, junction boxes, and panels. All wiring between panels and transmitters shall be labeled at both ends for ease of servicing.
- G. All terminations shall be made with solderless pressure connectors. All wiring shall be in accordance with the requirements of the wiring specifications.
- H. Grounding shall follow NEC and manufacturer requirements. Control signal ground wires shall be electrically connected to ground at a single location so as not to induce ground loops. When powering instrumentation from panels other than their associated control panel, isolation shall be used to interface with the instrument control signal at the control panel. Control signal grounding of instrumentation and equipment shall conform to the manufacturer's standards.
- I. Wiring in hazardous locations shall meet the requirements of the NEC. Installation of instrumentation located in Class I Division 1 locations shall conform to Article 504 of the NEC for Intrinsically Safe Systems. Personnel familiar with the installation of instrumentation in hazardous areas shall perform the installation.

3.2 NON-INTRUSIVE CALIBRATION CAPABILITY

- A. All sensor/transmitters can be calibrated without opening any enclosures.
- B. By means of a non-intrusive hand held wireless remote control unit or a HART hand held communicator, the sensor/transmitter will enter the calibration mode. The display of the sensor/transmitter will instruct the user on when to apply zero and span gas. The sensor/transmitter will automatically adjust its internal settings to the proper calibration values without further intervention by the user. Upon completion of a successful calibration, the sensor transmitter will exit the calibration mode. Date stamp of last successful calibration will be retained in the sensor/transmitter internal memory, with capability to be displayed on LCD. If calibration is unsuccessful for any reason, the display must show an unsuccessful calibration attempt and revert to its previous calibration settings. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable methods are to use a transmitter, which employs a digitally encoded infrared light beam, or a HART hand held communicator.

END OF SECTION

SECTION 40 75 00 – GAS DETECTORS

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SECTION 41 22 13.24 – MAST TYPE JIB CRANES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. Provide a complete and operating mast type jib crane with multiple mounting points as shown on the Contract Drawings and as specified herein.
- B. RELATED SECTIONS (Not Used)

1.2 SUBMITTALS

- A. Submit shop drawings and product data as a single complete initial submittal.
- B. Provide manufacturer’s installation, operation and maintenance manuals, bulletins, and spare parts lists.

1.3 QUALITY ASSURANCE

- A. Equipment furnished under this section shall be supplied by a single manufacturer that has provided similar equipment for projects of similar size and complexity in the recent past.

PART 2 -- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The jib crane shall be a Handling Systems International (HSI), telescoping boom, rotating mast type jib crane or approved equal.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Jib crane shall be classified by Underwriters Laboratories Inc. as to the specified load capacity and shall meet all applicable OSHA and ANSI standards. Other design requirements shall be as follows:

Table 2.2 A – PERFORMANCE REQUIREMENTS

Item	Value
Lifting capacity, pounds	
At 8’-8” Radius	6,000 lbs
At 14’-2” Radius	4,000 lbs

2.3 MATERIALS

- A. Materials shall be as follows:

SECTION 41 22 13.24 – MAST TYPE JIB CRANES

TABLE 2.3 A - MATERIALS

Component	Material
Mast and boom	A36 Steel
Bases	A36 Steel
Bolts and Connections	A36 Steel
Electric winch coating	Epoxy paint

2.4 EQUIPMENT

- A. General: One complete jib crane with one chain hoist and trolley shall be provided. Jib crane shall be installed in location shown on the drawings.
- B. Jib Cranes:
 - 1. The jib crane shall be capable of 360-degree rotation
 - 2. The jib crane shall be mast-type with a telescoping arm and designed by the manufacturer to handle a 3-ton load.
 - 3. Crane shall include rotation stops to prevent uncontrolled swiveling and damage to surrounding equipment, structures, or personnel
- C. Base: Base shall be permanently mounted and installed on concrete surfaces.
- D. Anchors: Provide all needed anchors as shown on Contract Drawings.
 - 1. Bolt torque specifications:

Bolt Diameter	Torque (ft-lbs)
1/4" – 20	6
3/8" – 16	20
1/2" – 13	50
5/8" – 11	95
3/4" – 10	175
7/8" – 9	300

- E. Chain Hoist:
 - 1. Hoist shall be manually operated with push trolley

SECTION 41 22 13.24 – MAST TYPE JIB CRANES

2. Chain hoist shall be lug mounted and able to accommodate tapered or flat-flanged beams
3. Hoist shall comply with ANSI/ASME B30.16, “Safety Standard – Overhead Hoists (Underhung)” and ANSI/ASME HST – 2M, “Performance Standard for Hand Chain Manually Operated Chain Hoists”
4. Hoist chain shall be 304 stainless steel.
5. Chain hoist manufacturers include, but are not limited to:
 - a. Budgit Hoists
 - b. Harrington Hoists
 - c. Columbus McKinnon
 - d. Coffing Hoists

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. The jib base shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 41 22 13.24 – MAST TYPE JIB CRANES

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SECTION 412223.19 – MONORAIL CHAIN HOIST

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section specifies furnishing, installing and testing a monorail chain hoist complete with hoist, trolley, controls, and electrification at the location shown. Included are all power panels, wiring, conduit and switching required to connect the equipment to the building utilities.

1.2 CITED STANDARDS

- A. Work shall conform to Federal and State governing rules and regulations and ordinances including, but not limited to the following requirements, and shall pass inspection by authorities having jurisdiction.
 - 1. National Electric Code (NEC)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Underwriters Laboratories (UL)
 - 4. Canadian Standards Association US Approved (CSA US)
 - 5. Crane Manufacturer's Association of America (CMAA)
 - 6. Hoist Manufacturer's Institute (HMI)
 - 7. American Institute of Steel Construction (AISC)
 - 8. American Society of Testing Materials (ASTM)
 - 9. Occupational Safety and Health Administration (OSHA)
 - 10. American National Standards Institute (ANSI)
 - 11. American Welding Society (AWS): Structural Welding Code Steel (AWS D 1.1)
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall take effect.
- C. Furnish all materials and labor necessary to meet these requirements and to obtain approvals of inspections and tests.
- D. Design of the monorail chain hoist shall be in general conformance to CMAA 70 and the Hoist Manufacturer's Institute Specification # HMI 100, except as otherwise specified herein. All structural steel members of the handling system shall be designed in accordance with the specifications of the AISC, current edition. And all welded construction shall be in accordance of the American Welding Society. Casting, forgings, and other similar items shall have a factor of safety of 5.
- E. Provide a permanent stainless steel embossed plaque to be located conspicuously on or near the power disconnect panel at ground floor level which indicates the hoist/trolley equipment numbers; working load capacity of the hoists/trolley and a statement that all records of inspection and testing are located in the utility's office.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Calculations

SECTION 41223.19 – MONORAIL CHAIN HOIST

4. Specifications to operate and/or maintain the equipment
5. Installation Instructions
6. Signed Certificates of Compliance
7. Warranty
8. Lists of all spare parts, supplies and consumables for the equipment
9. Submit schedules and comprehensive procedure for inspection and functional testing of the equipment
10. Provide manufacturer's installation operation and maintenance manuals, bulletins, and spare parts lists

1.4 QUALITY ASSURANCE

- A. Equipment furnished under this section shall be supplied by a single manufacturer that has provided similar equipment for projects of similar size and complexity in the recent past.
- B. Provide the services of a Manufacturer's Representative to perform functions as specified in Part 3 of this Section

PART 2 -- PRODUCTS

2.1 MONORAIL ELECTRIC CHAIN HOIST WITH PUSH TROLLEY (2 & 3 TON)

- A. Manufacturer: Manufacturers offering products or capable of manufacturing products meeting requirements include but are not limited to the following:
 1. Columbus McKinnon
 2. David Round Company Inc.
 3. Harrington
 4. Milwaukee
- B. General: Provide a bottom running electric hoist/trolley with pendant controls
 1. Hoist/trolley shall be supplied complete with all components and appurtenances required for operation including, but not limited to electric hoist, push trolley, end stops, controls, wiring, festoon, electrification, and the control pendant.
 2. Suspend hoist/trolley system from support structures provided under Division 5.
 3. Refer to structural drawings.
- C. Construction Features of the Hoist and Trolley:
 1. Spark-resistant construction
 2. Capacity/Range: 1/8 ton – 3 ton. Duty rating H4 – UL/CSA listed
 3. Motor/Hoist:
 - a. Extreme duty 1.3HP motor.
 - b. Fully enclosed in sealed aluminum body
 - c. Fan-cooled.
 - d. Precision machined helical gears
 - e. Variable Frequency Drive
 - f. External Fan
 - g. Long life friction clutch
 - h. Shafts: Standard shafts with spacers to accommodate a wide range of beam widths.
 4. Drop Stops: Standard

SECTION 412223.19 – MONORAIL CHAIN HOIST

5. Bumpers: Include Manufacturer's standard.
6. Hand Chain Drop: On geared trolleys.
7. Wheels: Steel with sealed ball bearings capable of fitting flat or tapered beam flange.
8. Hoist Pendant Drop: to 4 feet above finished floor
9. Hoist Power Supply Length: 15'
10. Pendant: 2-button (momentary contacts) with emergency on-off (maintained contacts).
11. Hook: Forged carbon steel with 360-degree ball bearings-swivel.
12. Chain: Nickel-plated Grade 80, DIN corrosion-resistant chain of adequate length to reach below grade pumps.
13. Color/finish: Safety yellow.

D. Electrification:

1. Voltage: 480V
2. Phase: 3 phase
3. Provide hard-wired service and festoon system
4. Equipment rated NEMA 7, Class 1, Division 1, Group D.
5. Explosion-proof

PART 3 -- EXECUTION

3.1 SITE CONDITION EXAMINATION (NOT USED)

3.2 FIELD QUALITY CONTROL

- A. Provide the services of a qualified manufacturer's representative to perform the following:
 1. Supervise preparatory work performed by other trades
 2. Supervise installation.
 3. Supervise testing, by the Contractor in the presence of the Owner's Representative to ensure proper operation of the equipment.

3.3 INSTALLATION

- A. Install equipment and all specified appurtenances and accessories in strict accordance with the approved shop drawings and manufacturer's installation instructions.
- B. Make final connections to all utility services provided for the equipment.

3.4 FIELD QUALITY CONTROL

- A. Provide the services of a qualified manufacturer's representative to perform the following:
 1. Supervise preparatory work performed by other trades.
 2. Supervise installation.
 3. Supervise testing, by the Contractor in the presence of the Engineer to ensure proper operation of the equipment.
 4. Instruct operating personnel in the proper operation and maintenance of the equipment.

3.5 TESTING PROCEDURES

- A. Startup testing shall be performed as follows:

SECTION 41223.19 – MONORAIL CHAIN HOIST

1. All tests shall be performed by the Contractor in the presence of the Engineer. Test loads shall not be more than 125% of the rated load of the crane unless otherwise recommended by the manufacturer. Contractor shall provide all required certifications for record.
 2. No-Load Test:
 - a. Hoist: Raise each load hook into the hoist limit switch at slow operating speed. Lower and raise each hook through all controller points.
 3. Full Rated Load Test:
 - a. Hoist:
 - i. Static Test: Raise test load approximately one foot and hold for ten minutes. Observe lowering that may occur which shall indicate malfunction of hoisting components or brakes.
 - ii. Dynamic Test: Hoist and lower test load through all pendant control points. Lower the test load to the ground until hoist lines are slack. Wait five minutes, hoist and lower test load again through pendant control points.
 - iii. Hoist Load Brake: Raise test load approximately five feet. With the hoist controller in the neutral position, release (by hand) the holding brake. The load brake should hold the test load. Again, with the holding brake in the released position start the test load down (first point) and return the controller to off position as the test load lowers. The load brake should prevent the test load from accelerating.
 - iv. During either the static or dynamic test, visually observe hoist brakes to ensure correct operation including the proper time delay.
 - v. Loss of Power Test: This test is designed to test the reaction of the hoisting unit in the event of power failure during a lift. Hoist the test load to convenient distance above the surface. Lower test load at slow speed and with the controller in the slow lowering position disconnect the main power source and return the controller to the neutral position. The test load should stop lowering when the controller is placed in the neutral position.
- B. Document procedures and results of all tests.
1. Perform test result measurements and calculations immediately following tests.
 2. Submit test results to Owner's Representative.

3.6 TRAINING

- A. After all equipment and systems have been installed, connected and tested, the Contractor shall provide training to Owner's personnel.

END OF SECTION