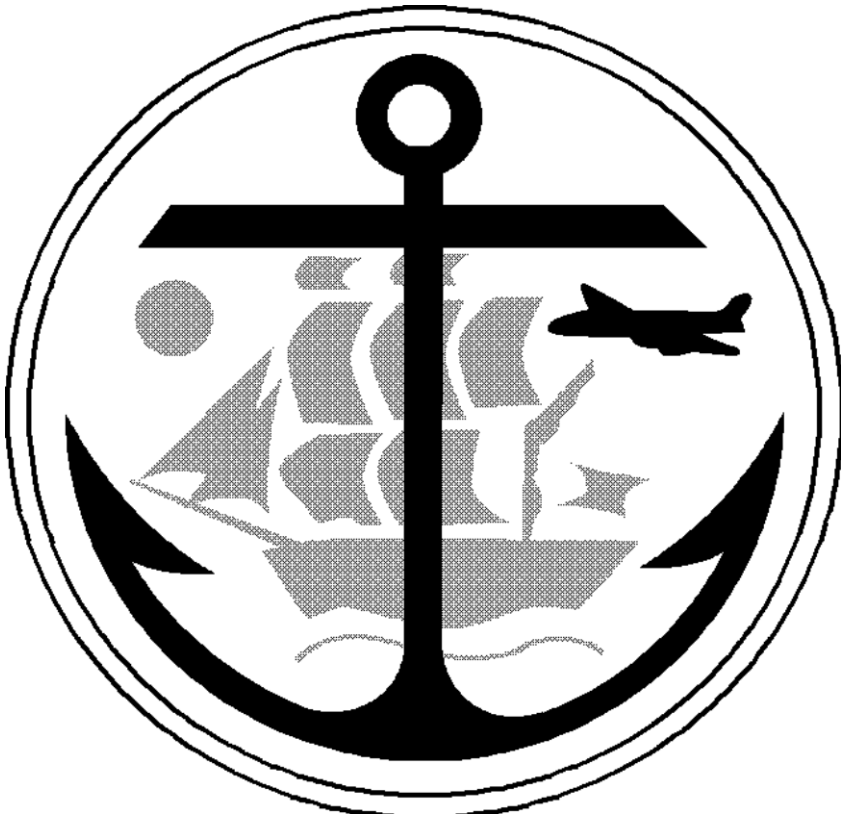
GWWTF Aeration System & Blower Upgrades

INVITATION TO BID NO. 2022C045



Municipality of Anchorage
Anchorage Water and Wastewater Utility
3000 Arctic Boulevard
Anchorage, AK 99503

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

MASTER INDEX

The most current version of the Municipality of Anchorage Standard Specifications (MASS) is provided on the Municipality website at

http://www.muni.org/departments/works/project_management/pages/mass.aspx.

Notifications will be sent when updates are made to the document, but each user of MASS is responsible to verify that they are using the most current version.

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION I

INVITATION TO BID

MUNICIPALITY OF ANCHORAGE
PURCHASING DEPARTMENT

Invitation to Bid

No. 2022C045

Sealed bids will be received in accordance with the time schedule shown below by the Municipality of Anchorage at the Purchasing Department, 632 W. 6th Ave., Suite 520, Anchorage, Alaska 99501 for:

GWWTF Aeration System & Blower Upgrades

The work for this Contract generally consists of structural, building mechanical, process mechanical, electrical, and instrumentation and controls to the existing aeration system located at the Girdwood Wastewater Treatment Facility:

Demolition and installation new systems (process mechanical, building mechanical, electrical, instrumentation and control, and plant control) as indicated on the Drawings and included in the Specifications.

> Furnish and install new equipment and provide on-site services from the selected blower manufacturer. Sequence work activities in a manner to minimize the number and duration of required shutdowns of wastewater treatment facilities. The OWNER'S ENGINEER will provide Plant SCADA system integration services for the Plant SCADA system. Provide support personnel and resources to the OWNER and OWNER'S ENGINEER to verify the function and performance of new equipment and instruments installed in this Project. Provide on-site training of the OWNER'S operations staff by the blower manufacturer and use operation and maintenance manuals as basis for instruction.

ESTIMATED CONSTRUCTION COST: **Between: $500,001 - $1,000,000**

Site Visit:	**10:00 A.M. Local Time, October 25, 2022** **238 Ruane Rd, Girdwood, AK 99587**
Pre-Bid Conference:	**3:00 PM Local Time, October 25, 2022**
Questions Due:	**Noon Local Time, October 27, 2022**
Bid Opening:	**2:00 P.M. Local Time, November 8, 2022**

All Pre-Bid Conferences and/or Bid Openings may be attended in person or via conference call at this number (907) 343-6089. You may call in five (5) minutes before any scheduled conference. EMAILED BIDS WILL NOT BE ACCEPTED.

ALL QUESTIONS SHALL BE SUBMITTED PRIOR TO THE QUESTION DUE DATE THIS WILL BE THE FINAL OPPORTUNITY TO ASK QUESTIONS OR REQUEST CLARIFICATIONS.

Requests for interpretation or clarification of the bidding Documents shall be made in writing to the Purchasing Office (wwpur@muni.org). Please reference the Invitation to Bid Number & Project Title. Do not contact the specified department directly.

To maintain the project schedule, Interpretations, corrections, or changes to the Bidding Documents shall be made by Addendum and shall not be binding unless included in the Addendum. It is your responsibility to periodically check the website for addenda.

At the above indicated time, the bids will be opened publicly and read. Bids must be received by the Purchasing Officer prior to the time fixed for opening of the bids to be considered. Time of receipt will be as determined by the time stamp in the Purchasing Office, Suite 520.

The Municipality of Anchorage reserves the right to reject any and all bids and to waive any informalities in the bids. No bidder may withdraw his bid after the hour set for the opening of bids or before the award of contract unless said award is delayed for a period exceeding sixty (60) days from the time of the opening.

The Municipality shall not be responsible for bid preparation costs, nor for costs, including attorney fees, associated with any (administrative, judicial or otherwise) challenge to the determination of the lowest responsive and responsible bidder and/or award of contract, and/or rejection of bids. By submitting a bid, each bidder agrees to be bound in this respect and waives all claims to such costs and fees.

Contracts shall be awarded by written notice issued by the Purchasing Officer to the lowest responsive and responsible bidder; however, preference will be given to local bidders in compliance with Anchorage Municipal Code Section 7.20.040.

The Municipality of Anchorage assumes no responsibility for any interpretations or presentations made by any of its officers or agents unless such interpretations or presentations are made by written addendum to this Invitation to Bid.

Bonding Requirements are per MASS/MASS B or as per special provisions

THE MUNICIPALITY OF ANCHORAGE IS AN "EQUAL OPPORTUNITY EMPLOYER"

PUBLISH ONE TIME

Date: October 17, 2022

Senior Buyer Assigned to this Project:
Melanie A Clark

Chris Hunter
Deputy Purchasing Officer

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION II

SPECIAL PROVISIONS

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

INDEX TO THE SPECIAL PROVISIONS

GENERAL PROVISIONS

GENERAL STATEMENT AND EXTENT OF WORK

All proposed Work for the Girdwood Wastewater Treatment Facility Aeration System and Blower Upgrade Project is located in Girdwood, Alaska, as shown on the Drawings. The Work included in this Contract consists of furnishing all labor, equipment, materials, supervision, factory and field testing, and other facilities necessary to complete the Work set forth in the Drawings, and Specifications, and terms of the Contract successfully.

The Work for this Contract consists of structural, building mechanical, process mechanical, electrical, and instrumentation and controls to the existing aeration system located at the Girdwood Wastewater Treatment Facility, 238 Ruane Drive, Girdwood, Alaska. The Work for this Contract generally consists of:

1. Demolition and installation new systems (process mechanical, building mechanical, electrical, instrumentation and control, and plant control) as indicated on the Drawings and included in the Specifications.

2. Furnish and install new equipment and provide on-site services from the selected blower manufacturer.

3. Sequence work activities in a manner to minimize the number and duration of required shutdowns of wastewater treatment facilities.

4. The OWNER'S ENGINEER will provide Plant SCADA system integration services for the Plant SCADA system.

5. Provide support personnel and resources to the OWNER and OWNER'S ENGINEER to verify the function and performance of new equipment and instruments installed in this Project.

6. Provide on-site training of the OWNER'S operations staff by the blower manufacturer and use operation and maintenance manuals as basis for instruction.

It shall be the responsibility of the bidder to prepare the bid so that all materials and working arrangements harmoniously conform to the intent of the Contract Documents.

SPECIFICATIONS, CODES, ORDINANCES, AND STANDARDS

The Contractor shall perform all Work in accordance with the Contract Documents, which include the most current edition of the **Municipality of Anchorage Standard Specifications**, (hereinafter referred to as MASS), as herein revised and supplemented as the Special Provisions.

The Contractor shall perform all Work in accordance with the latest edition of all applicable codes, ordinances, standards, and associated addenda including the AWWU Design and Constructions Practices Manual (hereinafter referred to as DCPM).

The MASS and DCPM are available for download at the following links:

MASS:

http://www.muni.org/departments/project_management/pages/mass.aspx.

DCPM:

http://www.awwu.biz/about-us/reliable-infrastructure/design-and-construction-practices-manual

CHANGES TO THE MUNICIPALITY OF ANCHORAGE STANDARD SPECIFICATIONS (MASS)

The following enumerated provisions of MASS are amended as hereinafter stated.

DIVISION 10 STANDARD GENERAL PROVISIONS

SECTION 10.01 DEFINITIONS

Add the following item in the list of definitions:

AKOSH – State of Alaska, Occupational Safety and Health Administration

As-Built Drawings – Revised set of (red lined) drawings submitted by the Contractor upon completion of the Work. The drawings are intended to reflect all changes made to the Contract drawings during the construction process, and show the exact dimensions, geometry, and location of all elements of the Work completed under the Contract.

Record Drawings – Final Contract (electronic) set of drawings submitted by the Engineer that incorporate changes and other elements of Work performed and documented by the Contractor and included in the “As-Build Drawings”.

OWNER – For the purposes of this Contract, the OWNER is AWWU.

GWWTF – This acronym refers to the Girdwood Wastewater Treatment Facility, where the project is located.

Shop Drawings – Contractor developed drawings that include erection (installation) drawings and product data. All shop drawings shall be prepared and submitted for review and approval by the OWNER or their representative prior to installing such work.

Disposal - Is herein defined as the transport of items from the Project site not scheduled for salvage, and delivery to a waste disposal site permitted to receive the items.

SECTION 10.02 BIDDING REQUIREMENTS AND CONDITIONS

Article 2.1 Examination of Bidding Documents and Site

Add the following paragraph to the end of the Article:

The Anchorage Water and Wastewater Utility published a Draft memorandum for the Girdwood Wastewater Treatment Facility – Aeration System and Blower Evaluation in August 2021 (Attachment A) that provides substantial background information and will be made available electronically for download by bidders.

SECTION 10.03 AWARD AND EXECUTION OF CONTRACT

Article 3.7 Contractor's Warranty

Delete the first sentence of the first paragraph and replace with the following:

The Contractor shall warranty all materials and workmanship for two (2) years from the Final Acceptance Date.

SECTION 10.04 SCOPE OF WORK

Article 4.8 Work Incidental to the Contract

Delete the numbered item thirteen and replace with the following:

13. Coordination of all removed items to be salvaged or disposed of with the Owner. Any items not identified by the Owner to be salvaged will be the responsibility of the Contractor to remove completely from the site and dispose.
14. All other items indicated on the Drawings or in these Specifications, that are necessary for the Work but not specifically listed as a bid item in these Contract Documents.

Article 4.12 Public Convenience and Access

Delete the second sentence of the first paragraph and replace with the following:

Without prior approval of the Owner, entrances or driveways of all kinds shall not be blocked for more than four (4) hours.

Article 4.17 Utilities

Add the following sentence to the end of the seventh paragraph:

Utility locates are the responsibility of the Contractor to request, coordinate with the Work, maintain, and protect.

Replace the list of Utility Companies in Article 2.7 E with the following:

Alaska Communications (ACS) - Larry Smith, 564-1812

Anchorage Water & Wastewater Utility (AWWU) – Joe Sanks, 564-2717

AT&T – Mike Barsalou 264-7325

Chugach Electric Association (CEA) – Gary Meadows, 242-2191

ENSTAR Natural Gas - Stan Staples 334-7777

GCI Cable – David Blehm, 868-6769

Municipal Light & Power (ML&P) – Victor Willis 263-5812

Municipal Street and Storm Drain Maintenance, Paul VanLandingham, 343-8372, or 317-7054

Municipal Street Light Maintenance– Kathy Bourque Parker, 343-8242

Municipal Traffic Signals Section – Mike Sickler, 343-8355

Solid Waste Services (SWS) – Evalu Filitaula, 343-6258 or 317-6863

Matanuska Electric Association (MEA) – Tom O'Hare, 761-9281

Matanuska Telephone Association (MTA) – Robbie Nash, 761-2704

Eagle River Street & Storm Drain Maintenance – Mark Littlefield, 343-1512

Alaska Waste – Josh James, 688-4446

Add the following new Articles:

Article 4.22 Responsibility of Contractor to Act in Emergency

In case of an emergency that threatens loss and/or injury of property and/or safety of life, the Contractor shall act, without previous instructions from the Engineer, as the situation may warrant. The Contractor shall notify the Engineer thereof immediately thereafter. Any claim for compensation by the Contractor, together with substantiating documents in regard to expense, shall be submitted to the Owner through the Engineer. The amount of compensation shall be determined by agreement.

The Contractor shall supply the Engineer, prior to commencement of Work, with an emergency telephone number through which a responsible Contractor's representative can be contacted on a twenty-four (24) hour a day basis.

Article 4.23 Daily Progress Reports

The Contractor shall submit daily progress reports to the Engineer. The reports for the current workweek shall be submitted no later than the following Monday by 12:00 p.m. The development, preparation, and presentation of all daily progress reports are incidental to the Contract and no separate payment shall be made. Each daily report shall include:

1. Names and hours worked for all personnel on site, including personnel for all subcontractors.
2. Construction equipment on hand, including utility vehicles such as pickup trucks, maintenance vehicles, etc.
3. Documentation of weather conditions and any resulting impacts to the Work.
4. General progress of the Work, including a list of activities started and completed, mobilization and demobilization of subcontractors, and major milestones achieved.

5. Contractor's plan for management of site (e.g., lay down and staging areas, construction traffic, etc.), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes.
6. Identification of new activities and sequences as a result of executed Contract changes (if any).
7. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
8. Changes to activity logic.
9. Changes to the critical path.
10. Identification of, and accompanying reason for, any activities added or deleted since the last report.
11. Steps taken to recover the schedule from Contractor caused delays.

SECTION 10.05 CONTROL OF WORK

Article 5.3 Construction Progress Schedule and Schedule of Values

Replace the second paragraph with the following:

The Contractor shall also deliver, at the same time as the Construction Progress Schedule, in a form satisfactory to the Engineer, a Schedule of Values detailing the costs of providing all labor, equipment, supplies, transportation, handling, and disposal in connection with the removal of system plant infrastructure as listed in the table below.

Plant system category	Plant system subcategory
Wastewater treatment and disposal plant	• Treatment structures and improvements • Wastewater treatment equipment

Work items not listed in a subcategory shall be incidental to the subcategory item.

A. Schedule of values format and content:

1. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
    a. Related specification section or division.
    b. Description of Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change orders (numbers) that affect value.
    g. Dollar value (percentage of contract sum to nearest percent, adjusted to total 100 percent).

2. Provide a breakdown of the contract sum in sufficient detail to facilitate continued evaluation of applications for payment and progress reports. Coordinate with the project manual table of contents. Break principal subcontract amounts down into several line items.

3. Round amounts to nearest whole dollar. The total shall equal the contract sum.

4. Provide a separate line item in the schedule of values for each part of the Work where applications for payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.

5. Provide separate line items on the schedule of values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Margins of cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in applications for payment. Each item in the schedule of values and applications for payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be either shown as separate line items in the schedule of values or distributed as general overhead expense, at the Contractor's option.

7. Schedule updating: Update and resubmit the schedule of values prior to the next applications for payment when Change Orders or construction change directives result in a change in the contract sum.

Add the following paragraph after the last paragraph:

The Contractor shall coordinate and provide a work schedule that includes temporary power supply measures to minimize impact and downtime to the EWTF and provide it to the Engineer for approval. Any deviation from this work schedule will require 48-hour notice and approval from the Engineer.

Article 5.4 Non-Working Hours, Holidays, Saturdays, and Sundays

Add the following sentence to the end of the last paragraph:

A standard workday is a ten (10) hour workday (excluding meal times) within the timeframe of no earlier than 7:00 a.m. and no later than 7:00 p.m.

Article 5.5 Shop Drawings

Add the following sentence to the end of the last paragraph:

Reference Section 01 30 00 – Submittals Procedures of the Technical Specifications for additional requirements.

Article 5.6 Product Data

Add the following sentence to the end of the last paragraph:

Reference Section 01 30 00 – Submittals Procedures of the Technical Specifications for additional requirements.

Article 5.7 Materials

Add the following sentence to the end of the last paragraph:

Reference Section 01 25 00 – Substitutions and Product Options and Section 01 60 00 – Delivery, Storage and Handling of the Technical Specifications for additional requirements.

Article 5.10 Subcontracting

Add the following item to the list:

5. The Contractor, at any time after award of contract, proposes to remove or make substitutions for MBE and/or WBE subcontractors or joint-venture partners under the contract, a written notice of such removal or substitution shall be submitted to the AWWU DBE Officer prior to commencement of performance of the affected work, with the names, addresses and phone numbers of the subcontractors or joint venture partners to be removed or substituted for and an explanation of the reasons for the removal and substitution. The Contractor shall make good faith efforts in accordance with the AWWU Disadvantaged Business Enterprise Program Specifications for Utility Contracts to utilize another MBE or WBE subcontractor as the replacement. These efforts shall be documented and the circumstances fully explained in writing, and approval obtained from the AWWU DBE Officer prior to such replacement. The AWWU DBE Officer shall, within seven (7) days of receipt of such notice, approve said notice or removal and substitution where it is shown that the requested action is for good cause and not for discriminatory purposes.

Article 5.22 Time for Completion of Work

Add the following sentence to the end of the first paragraph:

The Contractor shall complete all work under this Contract within three hundred and thirty-six (336) calendar days of the effective date of the "Notice to Proceed".

The Substantial Completion Date for this Contract shall be (30) calendar days prior to the Final Acceptance date.

Article 5.27 Liquidated Damages

Delete the first two sentences of the first paragraph and replace with the following:

The Owner may deduct out of any progress payment the sum of One Thousand Dollars ($1,000.00) per day as Liquidated Damages for each and every calendar day that the Substantial Completion Date is delayed beyond the Substantial Completion Date specified in Article 5.22, Time for Completion of Work.

The Owner may deduct out of any progress payment the sum of Two Thousand Dollars ($2,000.00) per day as Liquidated Damages for each and every calendar day

that the Final Acceptance Date is delayed beyond Final Acceptance Date specified in Article 5.22, Time for Completion of Work.

SECTION 10.06 LEGAL RELATIONS AND RESPONSIBILITIES

Article 6.6 Permits

Add the following sentence to the end of the sixth paragraph:

The Contractor shall identify the "Anchorage Water and Wastewater Utility" as the applicant on any permit application forms.

Article 6.9 Insurance

Remove and replace the fifth sentence of the first paragraph with the following:

The insurance company shall provide written notification to the MOA contract administrator of any material change, cancellation, or non-renewal of the insurance policies. If the insurer does not notify the MOA in these circumstances, it shall be the Contractor's responsibility to make that notification.

Article 6.14 Preference to Local Labor

Add the following paragraph to the end of the Article:

Notwithstanding page ix of the Wage & Hour Administration Pamphlet No. 600 contained in Section VIII of this Invitation to Bid and in accordance with Alaska Statute 36.10.040, this clause does not apply to this Invitation to Bid.

Article 6.15 State of Alaska Prevailing Wage Scale

Add the following paragraph to the end of the Article:

The Contractor, and all Subcontractors, are responsible to identify, pay, and report the higher of the prevailing wage rates on the proper forms. Those wages for which the Federal wage rate is higher, the Contractor, and all Subcontractors, shall report those wages on the Federal forms provided and included as part of the Federal wage determination contained elsewhere herein. The Contractor, and all Subcontractors, shall submit the Federal payroll forms directly to the Engineer **weekly**.

Article 6.16 Nondiscrimination

Add the following paragraph to the end of the Article:

The Contractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 40 CFR, Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or other legally available remedies.

Add the following new Article:

Article 6.19 Federal Contract Provisions – Retention of Records

Contractors shall retain all records of this Contract in accordance with 40 CFR 31.36(i)(10) that allows access by the grantee, the subgrantee, the Federal grantor

agency, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers, and records of the Contractor which are directly pertinent to that specific contract for the purpose of making an audit, examination, excerpts, and transactions.

Additionally, Contractors shall, in accordance with 40CFR 31.36(i)(11) retain all required records for a period of three (3) years after grantees or subgrantees make final payment and all other pending matters.

Add the following new Article:

Article 6.20 Federal Clauses Added by Reference

The Contractor shall comply with all provisions of the following federal clauses hereby incorporated by reference:

1. Copeland Anti-Kickback Act.
2. Section 306 of the Clean Air Act.
3. Section 508 of the Clean Water Act.
4. Energy Policy and Conservation Act (P.L. 94-163, 89 Stat.871).

Add the following new Article:

Article 6.21 Federal Certifications

The Contractor shall submit with its bid the following certifications:

1. Certification Regarding Debarment, Suspension, and Other Responsibility Matters (EPA Form 5700-49).
2. Certification of Non-Segregated Facilities.

Add the following new Article:

Article 6.22 Settlement of Procurement Issues and Bid Protests

In addition to Anchorage Municipal Code Section 7.20.130, Appeals, the following applies to this Invitation to Bid:

SETTLEMENT OF PROCUREMENT ISSUES. Grantees and subgrantees alone shall be responsible for the settlement of all contracts and administrative issues arising out of procurement. Grantees and subgrantees shall have procedures to handle and resolve procurement issues and shall disclose information regarding such issues to EPA. Such issues include, but are not limited to, source evaluation, bid protests, disputes, and claims.

EPA is not a party to any of the grantee's or subgrantee's subagreements for the construction of the proposed project. EPA's funding of this project does not relieve the grantee or subgrantee of any contractual responsibilities under its contracts. Reviews and approvals by EPA are: for administrative purposes only; used to determine compliance with Federal laws and regulations; and used to determine the level of Federal participation.

EPA will not substitute its judgment for that of the grantee or subgrantee unless the matter is primarily a Federal concern. Violations of law will be referred to the local, state, or Federal authority having jurisdiction. Reviews by EPA will be limited to the violations specified below. All other issues received by EPA will be referred to the grantee or subgrantee.

- Violations of Federal law or regulations and the standards. Violations of State or local law will be under the jurisdiction of state or local authorities; and
- Violations of the grantee's or subgrantee's protest procedures for failure to review a complaint or protest.

BID PROTESTS. Grantees and subgrantees will have procedures to resolve bid protest appeals and shall disclose information regarding the protest to EPA and the state. A protestor shall exhaust all administrative remedies at the grantee's and subgrantee's level before pursuing a protest with EPA.

Only parties with a financial interest that are adversely affected by the grantee's or subgrantee's decision on the initial bid protest may file a bid protest appeal with EPA. EPA will not substitute its judgment for the grantee or subgrantee unless the matter is primarily a Federal concern. Reviews by EPA will be limited to the violations described under the preceding section entitled "Settlement of Procurement Issues". Violations of law will be referred to the appropriate local or state authority.

Bid protest appeals shall be filed with the Office of Regional Counsel, EPA Region 10, ORC-158, EPA, Region 10, 1200 Sixth Avenue, Seattle, WA 98101. A protest appeal must:

- Be a written complaint regarding the grantee's or subgrantee's determination of a bid protest appeal;
- Include a copy of the grantee's or subgrantee's determination of the protest; and
- State the basis for the appeal.

The party filing the bid protest appeal shall concurrently transmit a copy of all protest documents and any attachments to all other financially interested parties that may be adversely affected by the determination of the protest appeal.

EPA will only consider written protest appeals received by the Office of Regional Counsel (ORC) within seven (7) calendar days; the adversely affected party can meet the seven day notice requirements by telegraphing or faxing to ORC within the seven calendar day period its intent to file a protest appeal, provided the adversely affected party submits a complete protest appeal within seven (7) calendar days of the date it sent the telegram or fax. If the seventh day falls on a Saturday, Sunday, or holiday, the next working day shall be the last day to submit a protest appeal.

For any protest appeal based upon alleged improprieties in the solicitation that were clearly apparent before receipt of initial proposals, EPA may dismiss as untimely any such appeals if the grantee or subgrantee does not receive the initial protest before bid opening or the closing date for receipt of proposals.

SECTION 10.07 MEASUREMENT AND PAYMENT

Article 7.1 Method of Measurement and Payment

Add the following to the end of this article:

Delete the second to the last article in each section of MASS except for Division 10, Sections 20.01, 60.01, and 70.01 and replace with the following: “No separate measurement for the respective section will be made.”

Article 7.2 Scope of Payment

Delete the second paragraph and replace with following:

The Contract will be paid on a lump sum basis and the Contract lump sum price shall constitute full compensation for providing all plant, labor, equipment, and materials and performing all operations required to complete the Work as specified in the Contract Documents. Notwithstanding the omission or mention of any incident or incidental work, the Contract price and payment will also constitute full compensation for all work incident or incidental to completion of the items. In the event any Work is required by the Contract Documents but is not identified as being directly incident or incidental to the completion of any Contract item, the Contract price for all enumerated items will also constitute full compensation of such Work.

Add the following to the end of this article:

Delete the last article in each section of MASS except for Division 10, sections 20.01, 60.01, and 70.01 and replace with the following: “No separate payment for the respective section will be made. This work will be considered incidental to the lump sum bid.”

Article 7.5 Progress Payments

Add the following paragraphs after the second paragraph:

A. Applications for payment

1. Each application for payment shall be consistent with previous applications and payments as certified by the Owner’s representative and paid for by the Owner.
    a. The initial application for payment, the application for payment at time of Substantial Completion, and the final application for payment involve additional requirements.
2. Application preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor.
    a. Entries shall match data on the schedule of values and the Contractor's construction schedule. Use updated schedules if revisions were made.
    b. Include amounts of Change Orders and construction change directives issued prior to the last day of the construction period covered by the application.

3. Transmittal: Submit one (1) signed and notarized original copy of each application for payment to the Owner's representative by a method ensuring receipt within twenty-four (24) hours. One copy shall be complete, including OEO reports and similar attachments, when required.
    a. Transmit progress payment with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Owner or Owner's representative.
4. Initial application for payment: Administrative actions and submittals, that must precede or coincide with submittal of the first application for payment, include the following:
    a. List of subcontractors.
    b. List of principal suppliers and fabricators.
    c. Schedule of values.
    d. Contractor's construction schedule (preliminary if not final).
    e. Schedule of principal products.
    f. Schedule of unit prices.
    g. Submittal schedule (preliminary if not final).
    h. List of Contractor's staff assignments.
    i. List of Contractor's principal consultants.
    j. Copies of permits.
    k. Initial progress report.
5. Application for payment at substantial completion: Submit an application for payment following issuance of substantial completion.
    a. This application shall reflect certificates of partial substantial completion issued previously for Owner occupancy of designated portions of the Work.
    b. Administrative actions and submittals that shall precede or coincide with this application include:
        i. Occupancy permits and similar approvals.
        ii. Warranties (guarantees) and maintenance agreements.
        iii. Maintenance instructions.
        iv. Changeover information related to Owner's occupancy, use, operation, and maintenance.
        v. Final cleaning.
        vi. List of incomplete Work, recognized as exceptions to Engineer's issuance of substantial completion.

Contractor shall submit, with the first application for payment, a copy of the Notice of Work executed by the State Department of Labor, Wage & Hour Administration. Failure to submit a copy of this form with the first application for payment will result in the withholding of $5,000 from the progress payment. Additionally, a filing may be issued to the Wage & Hour Administration for failure to provide such notice.

Delete the eighth item and replace with the following:

8. Failure of the Contractor or his/her Subcontractor to file reports with the AWWU Office of Equal Opportunity (OEO) as required by Anchorage Municipal Code, Regulations 7.50.004, 7.50.005, and 7.60.004, and as required by the Special Provisions in a timely manner shall result in monies being withheld in the amount of 10 percent of the amount due the Contractor until such time as the reports have been filed. The required submittals of the Disadvantage Business Enterprise Program, DBE Subcontractor Participation Form (ADEC/EPA FORM 6100-2) shall be made to the Engineer for transmittal to the AWWU OEO Office. Applications for payment will not be considered as having been received by the Engineer unless they are accompanied by a properly completed ADEC/EPA Form 6100-2.

   Upon receipt of progress billings by Subcontractors, and review and validation by the prime Contractor of satisfactory performance by its Subcontractors, the prime Contractor shall make payment for such work no more than 30 days from the prime Contractor's receipt of payment for said work from the Owner.

Add the following to the list of Withholdings, the fourth paragraph:

9. Failure to submit the detailed Schedule of Values consisting of several elements as required. (The Engineer cannot pay on any of the items specified to be broken down until the breakdown is received and accepted).

10. A maximum of $5,000 for failure to provide a Notice of Work and/or a Notice of Completion as required by Alaska Statute 36.05.045. For final payments, the difference between $5,000 and the actual amount paid for the Notice of Work filing shall be withheld until such time as the Contractor provides a copy of the Notice of Completion executed by the Wage & Hour Administration to the Engineer.

11. The value of items missing by the contract documents. Examples include, but are not limited to, record drawings; operations and maintenance manuals; Department of Labor Notice of Work and/or Notice of Completion, ADEC Notice of Completion form, or other items as listed in the schedule of values or elsewhere required in the contract documents.

Add the following sentence to the end of the list of withholdings:

Monies withheld under Article 7.5 - Progress Payments, shall be paid to the Contractor by subsequent pay estimates that follow the date on which the Contractor satisfactorily corrects the deficiencies causing the withholding.

Delete the fifth paragraph and replace with the following:

The amount of any withholding for items one (1) through eight (8) above shall be the reasonable value of the Work or remedy to be accomplished as estimated by the Engineer, without regard to bid amount of cost to the Contractor. The amount of withholding for items seven (9) through twelve (12) shall be in accordance with the claimed amount or the applicable Contract provisions.

Add the following paragraph to the end of the Article:

The monthly pay estimate shall be computed on the basis of Work completed. All quantities shall be subject to review by the Owner or Owner's representative prior to approval for payment. Monthly price allocation for payment of lump sum items shall be based on the approved construction progress schedule and schedule of values.

The State of Alaska funds this Contract (in part); therefore, the provisions of Alaska Statute 36, Section 36.90, and Article 3 entitled "Public Construction Contract Payment" apply.

Article 7.7 Final Payment

Add the following paragraphs after the first paragraph:

Additional administrative actions and submittals that must precede or coincide with submittal of the final application for payment include the following:

1. Evidence of completion of project closeout requirements.
2. Completion of items specified for completion after substantial completion and all applicable punch list(s) from the Engineer.
3. Proof that incomplete Work has been completed and accepted by the Owner.
4. Transmittal of required project construction records to the Owner's representative.
5. Removal of temporary facilities and services, surplus materials, rubbish, and similar elements.
6. Change of door and gate locks to Owner.
7. Approved redlines for Record Drawings.

Article 7.8 Correction of Work after Final Acceptance Date

Delete the first sentence of the first paragraph and replace with the following:

Placement of the Project on warranty shall not relieve the Contractor of his responsibility for paying all costs resulting from defects in materials or workmanship supplied under the terms of the Contract, and for correction of those defects, for a period of two (2) years following the Final Acceptance Date.

SECTION 10.08 FORMS

Delete this Section. All forms required for this Project are provided in Section IV of the Contract Documents.

SECTION 60.02 FURNISH AND INSTALL PIPE

Article 2.3 Materials

I. Fittings and Gaskets

Delete the first two sentences of the fifth paragraph and add the following:

Only carbon steel with hot dip galvanized (HDG) finish nuts, bolts, and washers shall be used.

Article 2.4 Construction

Add the following to the end of the first paragraph:

The water interruptions should only occur during periods of low influent flows, as determined by the Owner. The Contractor shall be responsible for minimizing the interruptions to wastewater treatment throughout the project.

END OF SPECIAL PROVISIONS

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION III

TECHNICAL SPECIFICATIONS

MUNICIPALITY OF ANCHORAGE
ANCHORAGE WATER AND WASTEWATER UTILITY

GIRDWOOD WWTF AERATION SYSTEM AND BLOWER UPGRADES
PID WM.00159

INDEX TO TECHNICAL SPECIFICATIONS

SECTION 01 10 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION OF WORK

A. The location of the Work is the Girdwood Wastewater Treatment Facility (GWWTF), 238 Ruane Drive, in Girdwood, Alaska.

1.02 SCOPE OF WORK

A. All equipment, materials, and manufactured articles incorporated into the Work covered under this Contract and furnished by the CONTRACTOR shall be new and recently manufactured, unless otherwise specifically approved by the OWNER. Previously owned, used, refurbished, reconditioned, remanufactured equipment and/or materials are not defined as new and are not acceptable.

B. The Work consists of, but is not limited to, the following:

1. Furnish and install two (2) new high-speed turbo (HST) blowers and the associated valves and piping modifications as shown in the Drawings. The high-speed turbo blowers shall be furnished from a single HST Blower Manufacturer. The HST Blower Manufacturer shall have sole responsibility for the fabrication, furnishing, commissioning and performance of blower equipment described in the Contract Documents.

2. Each high-speed turbo blower shall be furnished with the following optional features integrated into the blower enclosure:
   a. Thermal-magnetic main circuit breaker/disconnect with electronic trip unit
   b. Integral rotary power disconnect switch
   c. Variable frequency drive
   d. Harmonic filter
   e. Uninterruptible power supply for blower PLC

3. Furnish and install intake filter with freeze discouragement discharge-air knife system.

4. Furnish and install new coarse air bubble diffusers in the four (4) Aeration Basins and the Aeration Basin Splitter Box.

5. Furnish and install new instruments and controls systems associated with the blower upgrades.

6. Furnish and install new load center panel, relocate existing transformer, relocate heat trace system(s) in Blower Building as shown on the Drawings. Provide updated panel schedules at completion of project. Label all installed electrical equipment in accordance with Contract Documents.

7. Perform procedures for factory testing, field testing, start-up, commissioning, and training, of all equipment provided.

8. Demolish existing centrifugal blowers and concrete supports, air piping and diffusers, and ancillary electrical equipment to the extent described in the Contract Documents.

C. Under this Contract, the CONTRACTOR shall supply all labor, tools, equipment, materials, supplies, and manufactured articles, transportation, and services, including fuel, power, water, and essential communications, for performing all Work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents.

D. When in these Technical Specifications there is reference made to General Requirements or General Conditions, this shall refer to the requirements of Division 01 of these Technical Specifications. Where reference is made to General Provisions or Special Provisions, this shall refer to the MASS, Division 10.

E. Obtain all local permits and make all necessary arrangements with the local fire department and other authorities having jurisdiction (AHJ). Keep AHJs informed of activities throughout the performance of the work.

1.03 REQUIREMENTS FOR ACHIEVING SUBSTANTIAL COMPLETION

A. The following conditions, in addition to the requirements in MASS Division 10, shall be fulfilled before the Work is considered substantially complete:

1. Successful completion of the 7-day functional testing on the new high-speed turbo blowers and aeration equipment in auto-remote mode in accordance with Section 43 11 21.

2. Submittals have been completed and approved.

3. Spare parts and expendable supplies and test equipment have been delivered to OWNER.

4. Deficiencies listed in pre-final punch-list have been corrected and approved by the ENGINEER.

5. Red-lines included on Contract Drawings (in hard-copy format) have been submitted and approved.

6. Revisions to Operation and Maintenance Data that may have resulted from the field testing have been incorporated and reviewed and approved.

7. Construction debris has been removed.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 14 00
CONSTRUCTION CONSTRAINTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. CONTRACTOR shall submit a Work Plan that describes the CONTRACTOR'S phasing, and sequence of demolition and construction activities in the area of Work. The Work Plan shall identify those activities that may be performed concurrently and those that must be deferred or delayed until completion of other activities. The Work Plan shall complement the CONTRACTOR's schedule, to be developed in accordance with Section 01 32 00.

B. No physical work will be allowed to commence at the Project site prior to approval of the CONTRACTOR's schedule and the Work Plan required herein. Both the overall schedule and the Work Plan shall include all planned shutdowns.

C. The CONTRACTOR shall minimize shutdown times through advanced planning. Work shall not proceed prior to the approval of associated submittals as specified in the Contract Documents. For example, piping installation drawings shall be approved prior to the initiation of piping installation, etc. CONTRACTOR shall have all equipment, materials, and labor on hand at time of shutdown.

D. The existing wastewater treatment facility will be maintained in continuous operation during construction of the Project, except for limited shutdowns as described herein. To this end, the CONTRACTOR shall establish a schedule of proposed shutdowns in cooperation with the ENGINEER, which shall be updated when needed and shall be approved by the ENGINEER

E. The CONTRACTOR shall be responsible to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall Work.

F. Activities outlined herein do not cover the entire extent of Work included in the Project, and are the minimum required.

1.02 BASIS OF DESIGN

A. The Contract Documents are based on the NX40S-C080A high-speed turbo blower, manufactured by AGP-Neuros.

B. This equipment is similar to equipment used elsewhere in the AWWU system. Any design or construction changes resulting from supply of equipment from a different blower manufacturer shall be the sole responsibility of the CONTRACTOR, and all costs associated with re-design and/or construction changes shall be borne by the CONTRACTOR.

1.03 PLANT SHUTDOWNS OR OTHER IMPACTS TO TREATMENT PLANT PROCESSES

A. Unless the Contract Documents indicate otherwise, the CONTRACTOR shall not remove from service, de-energize, or modify settings for any existing operating equipment without written permission from the OWNER or OWNER's representative.

B. Where the Work requires modifications to the existing facilities, the CONTRACTOR shall submit a detailed shutdown plan and schedule for the OWNER'S approval a minimum of two (2) weeks in advance of the time that such shutdown is planned. A separate outage plan shall be submitted for each modification.

C. Under no circumstances shall a planned shutdown be more than four (4) hours.

D. Shutdowns shall be initiated and completed only during normal working hours of plant operating personnel, or as otherwise coordinated with and approved by the ENGINEER.

E. The CONTRACTOR shall submit a request to the ENGINEER for the removal of individual Aeration Basins to install new coarse air diffusers. The request shall be submitted a minimum of one (1) week in advance of the time that Work is planned. Only one (1) Aeration Basin will be removed from service at a time.

F. GWWTF plant staff will remove Aeration Basin No. 4 and Clarifier No. 4 from service and will remain out of service for the duration of the Project.

1.04 SEQUENCE OF ACTIVITIES

A. The CONTRACTOR shall incorporate the construction and schedule constraints of this Section in preparing the construction schedules required under MASS Division 10; Article 5.3 – Construction Progress Schedule and Schedule of Values.

B. The construction constraints in this Section do not include every item affecting the completion of the Work but are intended to describe the requirements and sequence of Work to minimize disruption to the treatment plant and to ensure compliance with AWWU operational requirements.

C. The CONTRACTOR'S schedule and Work activities shall account for construction constraints that include confining Work activities within the limits of construction shown on the Drawings.

D. At no time shall CONTRACTOR's activities place the OWNER'S discharge permit compliance at risk. At no time will other plant processes be disrupted to the point of causing an upset to the treatment process and/or an event of permit non-compliance.

E. There are operational and contractual constraints to the progression of the Work. The sequence of activities outlined herein is not mandatory as presented and shall not be interpreted to preclude CONTRACTOR's alternative approaches to sequencing the Work. The CONTRACTOR shall utilize a scenario such as presented to prepare and submit the CONTRACTOR's work plan that optimizes efficiency for the CONTRACTOR while limiting operational impacts to the OWNER.

F. Proposed sequence of activities of this Contract generally includes:

1. Maintaining the ability for AWWU to continuously provide air to the aeration basins at the GWWTF, as required by Alaska Department of Conservation (ADEC).

2. At no time will Contractor's activities place the Owner's discharge permit compliance at risk. At no time will other plant processes be disrupted to the point of causing an upset to the treatment process and/or an event of permit non-compliance.

3. The existing blowers shall remain in service until the new high-speed turbo blower equipment has been functionally tested in accordance with Section 01 46 50.

4. The following phases of work shall be completed by the Contractor in prosecuting the Work:
   a. GWWTF plant Operations continues use of the existing aeration system while the CONTRACTOR:
      1) Install housekeeping pads
      2) Electrical Demolition and Relocates
         a) Lights
         b) Breaker panel
         c) Conduits, conductors no longer used
         d) Relocate transformer and emergency lighting
      3) Demolition of existing LPA piping (Plant Shutdown Request Required)
         a) Disassemble Pond Aeration LPA piping in existing Blower Room
         b) Install black iron blind flange on 8-in Pond Aeration LPA
         c) Return existing blowers to service
      4) Main Process Building Piping Demolition over Clarifier No. 4
         a) Remove 8-in Pond Aeration LPA (green pipe) including hangers
         b) Remove Brown Piping including hangers
      5) Install new coarse air diffusers in Aeration Basin No. 1 thru 4, and Aeration Splitter Box
      6) Install new electrical and process piping
         a) Install electrical in new Blower Building
         b) Install pipe supports in Blower Building
         c) Install mechanical vent system upgrades in Blower Building
         d) Install seismic joint pipe support in area between buildings
         e) Install pipe supports for new 8-inch GSP LPA in Main Process Building
      7) Preassemble 8-inch GSP pipe and fittings
         a) Prepare an assembly of 8-inch LPA pipe and fittings for installation at existing header tee to connect to existing 8-inch PVC LPA piping
      8) Install/hang new 8-inch GSP LPA
         a) In Blower Building
         b) In area between buildings with Dektite flashings
         c) In Main Process Building up to existing 8-inch LPA header
      9) Prepare new 8-inch GSP for 3/4-inch Bubbler Piping for Clarifier Effluent Trough
         a) Install service saddle on 8-inch LPA piping to connect to existing 3/4-inch PVC line
      10) Remove and install new preassembled 8-inch GSP pipe and fittings at existing header tee (Plant Shutdown Request Required)
         a) AWWU plant staff to shutdown existing blowers
         b) Demolish existing 8-inch PVC LPA pipe at header tee
         c) Assemble replacement GSP pipe and fittings with relocated 8-inch BFV
         d) Install new 8-inch GSP pipe and fittings
         e) Connect new 8-inch GSP to installed GSP pipe and fitting assembly
         f) AWWU to put existing blowers back in service
      11) Insulate new LPA piping in Blower Building and Main Process Building
      12) Install and seismically anchor new high-speed turbo blowers
      13) Commission new high-speed turbo blowers
         a) When the new blowers are ready to be placed in service, the CONTRACTOR shall perform loop testing in accordance with Section 40 90 00.

b) Facilitate startup and commissioning of the high-speed turbo blower with blower manufacturer to confirm the performance of new blowers and aeration system
c) CONTRACTOR to commission new high-speed turbo blower equipment and appurtenances while utilizing Aeration Basin No. 4 only.

14) CONTRACTOR shall commission and functionally test new blower equipment in accordance with procedures that have been submitted and approved by the OWNER'S authorized representative, per Section 01 46 50. The CONTRACTOR shall provide qualified mechanical, electrical and instrumentation support to correct any deficiencies identified during the commissioning. The OWNER'S representative(s) shall witness commissioning, provide support, and coordinate testing activities with GWWTF plant Operations, per Section 01 46 50
15) Functional test new high-speed turbo blowers
a) Prior to placing Aeration Basin No. 1, 2 and 3 into service, or demolishing existing blower equipment, the CONTRACTOR shall complete the component and system testing of new blower equipment to the satisfaction of the OWNER or authorized representative.
16) Re-route new bubbler piping to supply air to Clarifier Effluent Troughs from new 8-inch GSP LPA piping

b. GWWTF plant staff will operate new high-speed turbo blowers while the CONTRACTOR performs:
1) Demolition of existing 8-inch PVC LPA piping over Clarifier No. 4
2) Demolition of existing blowers and sound enclosure
3) Demolition of existing blower housekeeping pads
4) Repair of holes in existing blower room floor

5. CONTRACTOR to support the OWNER'S SCADA System Integrator at time of commissioning new high-speed turbo blowers.

1.05 OPERATION OF OWNER'S EQUIPMENT

A. All operational shutdowns of the existing blower equipment to facilitate the CONTRACTORS operation will be performed by the OWNER. OWNER will shut down equipment with the appropriate lockout/tagout procedures.

1.06 SCHEDULE ALLOWANCE FOR SYSTEM INTEGRATION AND COMMISSIONING OF NEW BLOWER EQUIPMENT

A. The CONTRACTOR's CPM baseline project schedule shall include an allowance of five (5) consecutive days for the OWNER's SCADA System Integrator to perform SCADA integration to Girdwood WWTF Main PLC and AWWU System-wide SCADA Human-Machine Interface (HMI) system (iFix).

B. At the end of the 5 days, a functional testing phase for seven (7) consecutive days of successful operation and without significant interruptions of the systems in service under designed operating conditions and environment is required prior to issuing Substantial Completion.

1. During this time, the systems are operated by the OWNER with the CONTRACTOR providing maintenance, repairs, replacements, and correction of deficiencies, as required.

2. During commissioning, the systems may be operated throughout their specified ranges and modes of operation to demonstrate the required performance is met.

3. Until commissioning period is complete, and equipment/systems are accepted by the OWNER, the CONTRACTOR shall be fully responsible for the operation and maintenance of all new facilities.

4. Significant interruptions shall include failure of any critical equipment unit, system, or subsystem that is not satisfactorily corrected within 4 hours after failure.

1.07 PERMITS

A. The CONTRACTOR shall comply with conditions of all permits and shall obtain proof of satisfaction of conditions from issuers of permits prior to acceptance of the Work by the OWNER.

B. Conditions affecting the CONTRACTOR are found in the following permit:

1. Building Permit issued by the Department of Building and Safety, Municipality of Anchorage.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Provide for the following:

1. Area lighting shall be provided at all times to support construction and on-going treatment operations per Alaska OSHA and Illuminating Engineering Society (IES).

2. Control of fugitive dust shall be provided to prevent dust entry into existing electrical panels and enclosures.

END OF SECTION

SECTION 01 20 00
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE

A. This Section includes specification for the measurement and payment of the various elements of the Work; with provisions applicable to lump sum prices and allowances, if applicable.

B. In the case of conflict between this Section and the measurement methods specified in the individual technical Sections and the Special Provisions, the measurement methods in the technical specifications and Special Provisions shall govern.

C. Unit Price items are not used under this Contract. All Work shall be included in the lump sum bid price per the Bid Proposal form or as an allowance, where specified.

1.02 LUMP SUM ITEMS

A. Lump Sum measurement will be for the entire item, unit of Work, structure, or combination thereof, as specified and as indicated in the Bid Proposal Form. Measurement and payment for all bid items indicated as Lump Sums shall include the cost of all labor, materials and equipment necessary to furnish, install, clean, test, and place each bid item into operation; including permitting, general conditions, overhead and profit.

B. Progress payments will be based on the Schedule of Values prepared by the CONTRACTOR and approved by the OWNER before acceptance of the first Application for Payment.

C. In order for the CONTRACTOR to request progress payments against Lump Sum items, CONTRACTOR shall provide a disaggregation or breakdown in sufficient measurable detail that is acceptable to the OWNER.

D. Measurement

1. Measurement shall be based on the estimated percent complete of each item of the Schedule of Values, as approved by the OWNER.

E. Payment

1. Payment will be made at the Lump Sum price proportional to the completion percentages approved by the OWNER.

1.03 UNIT PRICE ITEMS (NOT USED)

1.04 ALLOWANCES

A. Allowances are considered provisional amounts to be used only if needed. Allowances are exclusive of Work indicated in the Contract Documents for which payment is included under the Lump Sum payment item. No Work may be performed under an allowance without prior written approval of the OWNER.

B. Any unused balance of the allowances shall revert to the OWNER upon completion of the Project. Prior to final payment, the original amount provided for allowances shall be adjusted to actual costs by deductive Change Order, adjusting the Contract price, accordingly.

C. The CONTRACTOR shall make no claim, nor receive any compensation, for anticipated profits, loss of profit, damages, or any extra payment due to any unexpended portion of the allowances.

D. No adjustment of Contract Time shall be allowed for any Work performed under allowance items.

E. Allowance items shall be included in the Schedule of Values.

F. Unless otherwise indicated in the specific measurement and payment provisions under allowance items, the measurable and allowable costs for Work performed under an allowance item shall be limited to the actual, demonstrable, and direct costs associated with that allowance item. Shipping and sales taxes are allowable costs.

1. No mark-up for overhead or profit shall be included for payment under an allowance account item. Overhead and profit shall be included in the Contract base bid or allocated across other bid items.

2. Work authorized by the OWNER under an allowance may be performed as a Lump Sum (negotiated before the fact), unit prices (when applicable), or time and material. For Work performed under time and material, CONTRACTOR shall submit detailed verification (break-down) of all costs, subject to the approval of the ENGINEER or OWNER.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 25 00
SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish and install products specified, under options and conditions for substitutions stated in this Section.

B. Whenever a product, material or item of equipment is specified or described by using the name of a proprietary product or the name of a particular manufacturer or vendor, the specific item mentioned shall be understood as establishing the type, function, dimension, appearance and quality desired. Unless the listings specifically state “No Substitutions,” other manufacturers’ or vendors’ products not named will be considered as substitutions, in accordance with MASS Article 5.7, provided the required information is submitted in the manner set forth in this Section, and provided the substitution will not require substantial revision to the Contract Documents.

1.02 SUBMITTAL OF LIST OF PROPOSED SUBSTITUTIONS

A. Bidders shall submit their list of proposed substitutions and the proposed monetary changes associated therewith together with their bids.

1.03 CONTRACTOR'S OPTIONS

A. For products specified only by reference standard, select products meeting that standard, by any manufacturer.

B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with specifications.

C. For products specified by naming one or more products or manufacturers and stating "or equal," submit a request for substitution(s), for any product or manufacturer which is not specifically named using the Substitution Request Form provided in Section IV of RFP Attachment A – Specifications and Contract Documents.

D. For products specified by naming only one product and manufacturer, there is no option and no substitution shall be allowed.

1.04 SUBSTITUTIONS

A. For substitutions to be considered, the CONTRACTOR shall submit, prior to Notice of Award, complete data as set forth herein to permit complete analysis of all proposed substitutions noted on the substitutions list. No substitution shall be considered unless the CONTRACTOR provides the required data in accordance with the requirements of this Section.

B. Submit a separate request for each substitution. Support each request with:

1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
   a. Product identification, including manufacturer's name and address.

b. Manufacturer's literature; identify:
   1) Product description.
   2) Reference standards.
   3) Performance and test data.
   4) Operation and maintenance data.
c. Samples, as applicable.
d. Name and address of similar projects on which product has been used, and date of each installation.

2. Itemized comparison of the proposed substitution with product specified; list significant variations. Substitution shall not change design intent and shall perform equal to that specified.

3. Data relating to impact on construction schedule occasioned by the proposed substitution.

4. Any effect of substitution on separate contracts.

5. List of changes required in other Work or products.

6. Accurate cost data comparing proposed substitution with product specified.
   a. Amount of any net change to Contract Sum.

7. Designation of required license fees or royalties.

8. Designation of availability of maintenance services, sources of replacement materials.

C. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on shop drawings or product data submittals without a formal request from CONTRACTOR.

2. They are requested directly by a subcontractor or supplier.

3. Acceptance will require substantial revision of Contract Documents.

D. Requests for substitutions submitted after Notice of Award will not be considered unless evidence is submitted to the OWNER or their representative that all of the following circumstances exist:

1. The specified product is unavailable for reasons beyond the control of the CONTRACTOR. Such reasons shall consist of strikes, bankruptcy, discontinuance of manufacturer, or acts of God.

2. The CONTRACTOR placed, or attempted to place, orders for the specified products within 10 days after Notice of Award.

3. Request for substitution is made in writing to the OWNER or their representative within 10 days of the date on which the CONTRACTOR ascertains that they cannot obtain the item specified.

4. Complete data as set forth herein to permit complete analysis of the proposed substitution is submitted with the request.

E. The OWNER or their representative's decision regarding evaluation of substitutions shall be considered final and binding. Requests for time extensions and additional costs based on submission of, acceptance of, or rejection of substitutions will not be allowed.

1.05 CONTRACTOR'S REPRESENTATION

A. In making formal requests for substitution, CONTRACTOR represents that:

1. CONTRACTOR has investigated proposed product(s) and has determined that it is equal to or superior in all respects to that specified.

2. CONTRACTOR will provide same warranties or bonds for substitution as for product specified.

3. CONTRACTOR will coordinate installation of accepted substitution into the Work and will make such changes as may be required for the Work to be complete in all respects.

4. CONTRACTOR waives claims for additional costs caused by substitution which may subsequently become apparent.

5. Cost data is complete and includes related costs under this Contract, including, but not limited to:
   a. Costs under separate contracts.
   b. OWNER or their representative's costs for redesign or revision of Contract Documents.

1.06 OWNER OR THEIR REPRESENTATIVE'S DUTIES

A. Review CONTRACTOR's requests for substitutions with reasonable promptness.

B. Notify CONTRACTOR, in writing, of decision to accept or reject requested substitution.

PART 2 PRODUCTS (NOT USED)

PART 3 PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 30 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the requirements for compiling, processing and transmitting submittals required for execution of the Project.

1.02 RELATED WORK

A. Additional submittal requirements are specified in the respective technical specification sections.

B. See Section 01 78 36 for Operations and Maintenance Manual requirements that supplement those requirements provided in the individual technical specification sections.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. All submittals shall be clearly identified as follows, using the Submittal Transmittal Form provided in Section IV of the Contract Documents:

1. Date of Submission.
2. Project Number.
3. Project Name.
4. CONTRACTOR Identification.
   a. CONTRACTOR.
   b. Supplier.
   c. Manufacturer.
   d. Manufacturer or supplier representative.
5. Submittal number (see instructions below, under Numbering System)
6. Identification of the product.
7. Reference to Contract Drawing.
8. Reference to specification section number, page and paragraph(s).
9. Reference to applicable standards, such as ASTM or Federal Standards numbers.
10. Indication of CONTRACTOR's approval.
11. CONTRACTOR's Certification statement.
12. Identification of deviations from the Contract Documents, if any, using the Deviation Request Form.
13. Reference to previous submittal (for resubmittals).

14. American Iron and Steel Provisions (as applicable).

B. Submittals shall be clear and legible, and of sufficient size for legibility and clarity of the presented data.

C. Submittal Log: Maintain a log of all submittals. The submittal log shall be kept accurate and up to date. This log should include the following items (as applicable):

1. Description.

2. Submittal number.

3. Date transmitted to the OWNER or their representative.

4. Date returned to CONTRACTOR (from OWNER or their representative).

5. Status of submittal (No Exception Taken/ Make Corrections Noted/etc.).

6. Date of resubmittal to OWNER or their representative, and return from OWNER or their representative (if applicable, and repeat as necessary).

7. Date material released for fabrication.

8. Projected (or actual) delivery date.

D. Numbering System: Utilize the following submittal identification numbering system:

1. The first character shall be a D [Shop Drawing (including erection drawings and product data)], S [Sample], M [Manual (Operating & Maintenance)] or I [Informational].

2. The next six digits shall be the applicable Section Number.

3. The next three digits shall be the sequential number of each separate item or drawing submitted under each Specification Section, in the chronological order submitted, starting at 001.

4. The last character shall be a letter, A to Z, indicating the submission (or resubmission) of the same submittal, i.e., "A" = 1st submission, "B" = 2nd submission, "C" = 3rd submission, etc. A typical submittal number would be as follows:
   a. D-033000-008-B, where:
      1) D = Shop Drawing.
      2) 03 30 00 = Section for cast-in-place concrete.
      3) 008 = the eighth different submittal under this Section.
      4) B = the second submission (or first re-submission) of that particular shop drawing.

E. Submittals

1. Shop Drawings
   a. Shop drawings may include, but are not necessarily limited to, custom prepared data such as fabrication and erection (installation) drawings, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, valve

schedules, wiring diagrams, coordination drawings, equipment inspection and test reports, and performance curves and certifications, as applicable to the Work.

b. CONTRACTOR shall verify all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and coordinate each item with other related shop drawings and the Contract requirements.

c. All shop drawings submitted by subcontractors and vendors shall be reviewed by the CONTRACTOR. CONTRACTOR shall confirm, materials, dimensions, catalog numbers, technical data and performance criteria; and shall coordinate with other related shop drawings and the Contract requirements. In addition, CONTRACTOR shall confirm existing field conditions and dimensions and ensure that the submittal is coordinated and compatible with existing conditions. Submittals directly from subcontractors or vendors will not be accepted.

d. The CONTRACTOR shall be responsible for the accuracy of the subcontractor's or vendor's submittal, and for their submission in a timely manner to support the requirements of the CONTRACTOR's construction schedule. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractor or vendor to correct, before submission to the OWNER or their representative. All shop drawings shall be approved by the CONTRACTOR.

2. Erection (Installation) Drawings

a. Detailed erection (installation) drawings (equipment, piping, electrical conduits and controls, HVAC work, and plumbing, etc.) shall be prepared and submitted for review and approval by the OWNER or their representative prior to installing such Work. Installation drawings shall be to-scale and shall be fully dimensioned.

b. Piping installation drawings shall show the laying dimensions of all pipes, fittings, and valves, as well as the equipment to which it is being connected. In addition, all pipe supports shall be shown.

c. Equipment installation drawings shall show all equipment dimensions, anchor bolts, support pads, piping connections and electrical connections. In addition, show clearances required around such equipment for maintenance of the equipment.

d. Electrical installation drawings shall show conduits, junction boxes, disconnects, control devices, lighting fixtures, support details, control panels, lighting and power panels, and Motor Control Centers. Coordinate all locations with the Contract Documents and the CONTRACTOR's other shop drawings.

3. Product Data

a. Product data, as specified in individual Specification Sections, include, but are not limited to, the manufacturer's standard prepared data for manufactured products (catalog data), such as the product specifications, installation instructions, availability of colors and patterns, rough-in diagrams and templates, product photographs (or diagrams), wiring diagrams, performance curves, quality control inspection and reports, certifications of compliance (as specified or otherwise required), mill reports, product operating and maintenance instructions, recommended spare parts and product warranties, as applicable.

4. Samples

a. Furnish samples required by the Contract Documents for the OWNER or their representative's approval. Samples shall be delivered to the OWNER or their representative as specified or directed. Unless specified otherwise, provide at least two samples of each required item. Materials or equipment for which samples are required

shall not be used in the Work unless and until approved by the OWNER or their representative.

b. Samples specified in individual Specification Sections may include, but are not limited to, physical examples of the Work (such as sections of manufactured or fabricated work), small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and other specified units of Work.

c. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify and Contract Requirements.

d. Approved samples not destroyed in testing shall be sent to the OWNER or their representative, or stored at the site of the Work. Approved samples of the hardware in good condition will be marked for identification and may be used in the Work. Materials and equipment incorporated in Work shall match the approved samples. Samples which fail testing or are not approved will be returned to the CONTRACTOR at his expense, if so requested at time of submission.

5. Delays to construction due to the untimely submission of submittals will constitute inexcusable delays, for which CONTRACTOR shall not be eligible for additional cost nor additional Contract time. Inexcusable delays consist of any delay within the CONTRACTOR's control.

6. The review of shop drawings, erection drawings, product data, or samples by the OWNER or their representative, and subsequent submittal review action(s) shall not relieve the CONTRACTOR from the responsibility for the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the CONTRACTOR, and the OWNER will have no responsibility, therefore.

7. No portion of the Work requiring a shop drawing (including erection drawings and product data) or sample shall be started, nor shall any materials be fabricated or installed, before approval of such item. Procurement, fabrication, delivery or installation or products or materials that do not conform to approved shop drawings shall be at the CONTRACTOR's risk. Furthermore, such products or materials delivered or installed without approved shop drawings, or in non-conformance with the approved shop drawings, will not be eligible for progress payment until such time as the product or material is approved or brought into compliance with approved shop drawings. Neither the OWNER nor ENGINEER will be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

8. Operation and Maintenance Data
   a. Operation and maintenance data shall be submitted in assembled manuals and in accordance with Section 01 78 36.

9. Site Usage
   a. Submit a proposed site staging plan including, but not limited to, the location of office trailers, storage trailers, material laydown and temporary facilities specified in Section 01 51 00. Such plan shall be a graphic presentation (drawing) of the proposed locations; and, shall include on-site traffic patterns and parking areas, and temporary utilities, as may be applicable.

10. Shop Drawing Schedule

a. Prepare and submit a schedule indicating when shop drawings are required to be submitted to support the as-planned construction schedule. The submittal schedule shall allow sufficient time for preparation and submittal, review and approval, and fabrication and delivery to support the construction schedule.

11. Statements of Qualifications
    a. Provide evidence of qualification, certification, or registration, as required in the Contract Documents, to verify qualifications of licensed land surveyor, professional engineer, materials testing laboratory, specialty subcontractor, technical specialist, consultant, specialty installer, and other professionals.

12. Health and Safety Plans
    a. Prepare and submit a general company Health and Safety Plan (HSP), modified or supplemented to include job-specific considerations.

13. Construction Photography and Videography
    a. Provide preconstruction photographs and/or video, monthly progress photos and/or video, and post-construction photographs and/or video.

14. Outage Requests
    a. Provide fourteen (14) day notification of any outages (electrical, flow processes, etc.) as may be required to replace existing facilities.

15. Proposed Testing Procedures
    a. Prepare and submit testing procedures proposed to use to perform testing required by the various technical specifications and in accordance with Section 01 46 50.
    b. Provide copies of all test records and reports.

16. Vendor Training Outlines/Plans
    a. At least two (2) weeks before scheduled training of OWNER's personnel, provide lesson plans for vendor training in accordance with Section 01 78 36 (including O&M manuals).

17. Manufacturer Test and Start-up Reports
    a. Manufacturers shall perform all pre-start-up installation inspection, calibrations, alignments, and performance testing, as specified in the respective Specification Section. Provide copies of all such test and start-up reports.

18. Certifications
    a. Provide various certifications as required by the technical specifications. Such certifications shall be signed by an officer (of the firm) or other individual authorized to sign documents on behalf of that entity.
    b. Certifications may include, but are not limited to:
        1) Welding certifications and welders qualifications
        2) Certifications of Installation, Testing and Training for all equipment
        3) Material testing reports furnished by an independent testing firm
        4) Certifications from manufacturer(s) for specified factory testing

19. Record Drawings
    a. No later than Substantial Completion, submit a record of all changes during construction not already incorporated into drawings.

20. Submittals required by laws, regulations and governing agencies
    a. Prepare and submit all documentation required by state or local law, regulation or government agency directly to the applicable agency. This includes, but is not limited to, notifications, reports, certifications, certified payroll (for projects subject to wage requirements) and other documentation required to satisfy all requirements. Provide to OWNER or their representative one copy of each submittal made in accordance with this paragraph.

21. Submittals required by funding agencies
    a. Prepare and submit all documentation required by funding agencies. This includes, but is not limited to, segregated pay applications and change orders when required to properly allocate funds to different funding sources; and certified payrolls for projects subject to wage requirements. Provide one copy of each submittal made in accordance with this paragraph to the OWNER or their representative.

22. Warranties and Bonds
    a. No later than Substantial Completion, assemble a booklet or binder of all warranties and bonds as specified in the various technical specifications, and provide two originals to the OWNER or their representative.

23. As-Built Surveys
    a. If required, engage the services of a licensed land surveyor. Prior to Final Completion, provide an as-built survey of the constructed facility.

24. Contract Close-Out Documents
    a. Submit Contract documentation in accordance with Section 01 77 10.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL SCHEDULE

A. Provide an initial submittal schedule at the pre-construction meeting for review by OWNER and ENGINEER. Incorporate comments from OWNER or ENGINEER into a revised submittal schedule.

B. Maintain the submittal schedule and provide sufficient copies for review by OWNER and ENGINEER. An up-to-date submittal schedule shall be provided at each Project progress meeting.

3.02 PROCEDURES

A. Submittals

1. CONTRACTOR's Responsibilities
    a. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related Work or other applicable activities, or within the time specified in the individual Work of other related Sections, so that the installation will not be delayed by processing times, including disapproval and resubmittal (if required). Coordinate with other submittals, testing, purchasing, fabrication, delivery

and similar sequenced activities. Extensions to the Contract Time will not be approved for the CONTRACTOR's failure to transmit submittals sufficiently in advance of the Work.

b. The submittals of all shop drawings (including erection drawings and product data) shall be sufficiently in advance of construction requirements to allow for possible need of re-submittals, including the specified review time.
c. Submittals of operation and maintenance data shall be provided within 30 days of approval of the related shop drawing(s).
d. Before submission, review shop drawings (including erection drawings and product data) as follows:
    1) Make corrections and add field measurements, as required.
    2) Use any color for its notations except "RED" (reserved for the OWNER or their representative's notations) and black (to be able to distinguish notations on black and white documents).
    3) Identify and describe each and every deviation or variation from Contract Documents or from previous submissions, except those specifically resulting from a comment on a previous submission.
    4) Highlight information applicable to the Work and/or delete information not applicable to the Work.
e. Submit the following number of copies:
    1) All submittals shall be provided in electronic format and with hard copies as detailed below:
        a) Shop drawings (including erection drawings and product data) – two copies
        b) Samples – two copies
        c) Schedule of values –three copies
        d) Signed payment application format – three copies
f. When the shop drawings have been completed to the satisfaction of the OWNER or their representative, carry out the construction in accordance therewith; and make no further changes therein except upon written instructions from the OWNER or their representative.

2. OWNER or Their Representative's Responsibilities
    a. OWNER or their representative will not review shop drawings (including erection drawings and product data) that do not include a completed Submittal Transmittal cover sheet. Such submittals will be returned to the CONTRACTOR, without action, for correction.
    b. Partial shop drawings (including erection drawings and product data) will not be reviewed. If, in the opinion of the OWNER or their representative, a submittal is incomplete, that submittal will be returned to the CONTRACTOR for completion. Such submittals may be returned with comments from the OWNER or their representative indicating deficiencies requiring correction.
    c. If shop drawings (including erection drawings and product data) meet the submittal requirements, OWNER or their representative will forward the electronic file and hard copies to appropriate reviewer(s). Otherwise, noncompliant submittals will be returned to the CONTRACTOR without action, with the OWNER or their representative retaining one copy.
    d. No more than 30 calendar days will be required for OWNER or their representative's review time for shop drawings and O&M manuals involving only one engineering discipline. No more than 45 calendar days will be required for OWNER or their representative's review time for shop drawings and O&M manuals that require review

by more than one engineering discipline. Resubmittals will be subject to the same review time.

3. Review of Shop Drawings (Including Erection Drawings and Product Data) and Samples.
   a. The review of shop drawings, erection drawings, data, and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:
      1) as permitting any departure from the Contract requirements
      2) as relieving the CONTRACTOR of responsibility for any errors, including details, dimensions, and materials
      3) as approving departures from details furnished by the OWNER or their representative, except as otherwise provided herein
   b. The CONTRACTOR remains responsible for details and accuracy, for coordinating the Work with all other associated Work and trades, for selecting fabrication processes, for techniques of assembly, and for performing Work in a safe manner.
   c. If the shop drawings (including erection drawings and product data) or samples as submitted describe variations and indicate a deviation from the Contract requirements that are in the interest of the OWNER, and are so minor as not to involve a change in Contract Price or Contract Time, the OWNER or their representative may return the reviewed drawings without noting an exception.
   d. Only the OWNER or their representative will utilize the color "RED" in marking submittals.
   e. Submittals will be returned to the CONTRACTOR with one of the following submittal review action codes.
      1) Code 1 – "NO EXCEPTION TAKEN" – This code is assigned when there are no notations or comments on the submittal. When returned under this code the CONTRACTOR may release the equipment and/or material for manufacture.
      2) Code 2 - "MAKE CORRECTIONS NOTED" - This code is assigned when a confirmation of the notations and comments is required by the CONTRACTOR. The CONTRACTOR may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the OWNER or their representative within 15 calendar days of the date of the transmittal requiring the confirmation.
      3) Code 3 - "AMEND AND RESUBMIT " - This code is assigned when notations and comments are extensive enough to require a resubmittal of the entire package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received within 30 calendar days of the date of the transmittal requiring the resubmittal.
      4) Code 4 – "REJECTED RESUBMIT" – This code is assigned when the submittal does not meet the intent of the Contract Documents. The CONTRACTOR must resubmit the entire package, revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the Contract Documents.
   f. Repetitive Reviews: Shop drawings, O&M manuals, and other submittals will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at the CONTRACTOR's expense. Reimburse the OWNER for all costs for the third and subsequent reviews by all parties, including the ENGINEER.

4. Electronic Transmission

a. Submittals may be transmitted by electronic means, provided the following conditions are met:
   1) The Submittal Transmittal cover sheet is included at the beginning of the file.
   2) All other requirements specified above have been met, including, but not limited to, coordination by the CONTRACTOR, review and approval by the CONTRACTOR, and the CONTRACTOR's Certification.
   3) The submittal contains no pages or sheets large than 11x17 inches.
   4) The entire submittal is included in a single file, with Submittal Transmittal at the beginning of the file.
   5) The electronic files are PDF format (with printing enabled).
   6) Transmit three hard-copy (paper) originals to the OWNER or their representative, if requested.
   7) Review time will commence upon receipt of the electronic file and hard copies of the submittal, if requested.

END OF SECTION

SECTION 01 32 00
CONSTRUCTION SCHEDULING

PART 1 GENERAL

1.01 DESCRIPTION

A. A Critical Path Method (CPM) construction schedule shall be used to control the Work and to provide a basis for determining job progress. The construction schedule shall be prepared and maintained by the CONTRACTOR. All Work shall be done in accordance with the established CPM schedule. The CONTRACTOR and all subcontractors shall cooperate fully in developing the construction schedule and in executing the Work in accordance with the CPM schedule.

B. The construction schedule shall consist of a computerized CPM network (diagram of activities) presented in a time-scaled graphic (print-out) with reports, as specified herein.

1.02 SUBMITTALS

A. CONTRACTOR shall submit Baseline (also known as "as-planned") CPM schedules, revisions, and Monthly Status Reports, all including graphics, reports, and narratives, as specified herein.

PART 2 PRODUCTS

2.01 SOFTWARE

A. Unless otherwise approved by the OWNER or their representative, the computer-based schedule shall be generated using Oracle-Primavera CONTRACTOR, or P6 Professional Project Management Software.

2.02 NETWORK REQUIREMENTS

A. Each schedule submittal shall contain the following identifying information:

1. Project Title, OWNER's Contract Number

2. All Contract milestones, as specified

3. The Project calendar(s) (including work week and holidays)

B. The network of activities shall show the order and inter-dependence of activities, and show the sequence in which the Work is to be accomplished, as planned by the CONTRACTOR. The basic concept of a network analysis diagram shall be followed to show how each activity is dependent on preceding activities (predecessors) and following activities (successors).

C. Detailed network activities shall include, but are not limited to:

1. Mobilization activities.

2. Procurement activities (submittals, review and approval, fabrication, and delivery).

3. Permitting and regulatory activities.

4. Right-of-way activities (including utility agreements that require others to relocate existing utilities that affect the Project).

5. Construction activities (including demolition, rehabilitation, new construction and testing).

6. Test and start-up activities [including testing (i.e., component, system, operational), training, and commissioning].

7. Contract milestones (fixed and floating).

8. Specified sequences, outages and coordination activities.

9. Any other activities needed to properly identify the Scope of Work and Contract requirements.

D. All activities shall be sufficiently identified and/or described so that the Scope of Work of each activity is clear. All Work tasks shall be broken down into appropriate scopes and durations to facilitate monitoring progress. Unless otherwise approved by the OWNER or their representative, no activities shall have durations of more than one month; except for off-site activities, such as procurement and delivery of materials and equipment, or administrative or management activities that span the Project duration that do not reflect earned progress.

E. Network activities shall be organized (grouped) by phases (or stages), physical areas, buildings, elevations, or other portions of the Project.

F. Separate network activities shall be provided for each significant identifiable function in each trade area in each facility. Separate network activities shall be provided for subcontractors.

G. The number of network activities, sufficiency of description, and level of breakdown shall be subject to the OWNER or their representative's review and approval to confirm conformance with the specified requirements.

H. The format of the schedule network graphic shall be a time-scaled logic diagram, with a list of network activities and the specified data fields presented adjacent to the graphic display.

I. The following general requirements also apply to the network diagram.

1. The Critical Path (the sequence of Project network activities that add up to the longest overall duration, and thereby determines the shortest time possible to complete the Project) shall be identified.

2. A seven (7) calendar day week shall be used as a basis for developing construction scheduling.

3. The project calendar shall include exclusions for holidays observed by the CONTRACTOR and those indicated in the Contract Documents.

J. Each network activity shall have the following information (fields) listed alongside the activity on the graphic display.

1. Activity ID and Description – a manually assigned designation (numeric or alphanumeric). The CONTRACTOR should use a logical approach to assigning identification to network activities to facilitate grouping (sorting) of activities.

2. Original Duration – including allowances for adverse weather interruptions normal for the Project location. Normal weather shall mean seasonally average weather conditions, as recorded by NOAA.

3. Percent Complete – the CONTRACTOR's estimated percent complete for each network activity as of the data date for the respective report.

4. Remaining Duration – a calculated value based on Original Duration of each network activity and the estimated percent of completion for each activity.

5. Early Start Date and Early Finish Date.

6. Late Start Date and Latest Finish Date.

7. Total Float.

2.03 SUBMITTAL REQUIREMENTS

A. Each schedule submittal shall include the following elements:

1. Graphics – unless otherwise approved, the network graphics shall be printed on 24-inch by 36-inch sheets; including a list of activities and the specified data fields.

2. Narrative
   a. The Narrative shall consist of a written report by the CONTRACTOR providing an overview of the schedule, specific to each submittal.
   b. The Narrative for the Baseline Schedule shall:
      1) explain key activities and assumptions on which the schedule is based;
      2) describe the Critical Path;
      3) discuss key deliveries that might adversely affect the Project schedule; and,
      4) explain the CONTRACTOR's approach to adverse weather interruptions normal for the Project location. Normal weather shall mean seasonally average weather conditions, as recorded by NOAA.
   c. The Narratives provided with Monthly Status Reports (updates) shall also identify:
      1) any changes the CONTRACTOR has made to the CPM logic (including any added, modified or deleted activities);
      2) any delays that have been encountered; and
      3) remedial actions or recovery steps the CONTRACTOR will employ to recover from such delays.

B. Reports

1. The following reports are required to be submitted with Baseline Schedule when a major revision is made to the schedule, and when requested by the OWNER or their representative:
   a. Activity – a report listing all network activities, sorted by Activity ID.
   b. Early Start – a report listing all network activities, sorted by Early Start date.

c. Total Float – a report listing all network activities, sorted by Total Float (ascending from low to high).
d. Predecessor/Successor – a report of all activities, sorted by Activity ID that lists all predecessor and successor activities for each network activity.

2.04 ACCEPTABILITY

A. The CONTRACTOR shall submit the CPM schedule submittals, as specified, and resubmit as needed, until they are in compliance with Contract requirements.

B. The OWNER or their representative's review of the CONTRACTOR's schedule submittals will only be for conformance with the Contract requirements, including, but not limited to, Contract time and Work sequences specified in the Contract Documents. The OWNER or their representative's review of the schedule shall not include the CONTRACTOR's means and methods of construction or safety. The OWNER or their representative's concurrence, acceptance, or approval of the CONTRACTOR's schedule submittals will not relieve the CONTRACTOR from responsibility for complying with the Contract Scope, Contract Time or any other Contract requirement. Any indication of concurrence, acceptance, or approval of the CONTRACTOR's schedule will only indicate a general conformance with the Contract Requirements.

C. Review of the CONTRACTOR's schedule submittals shall not relieve the CONTRACTOR from responsibility for any deviations from the Contract Documents unless the CONTRACTOR has in writing called the OWNER or their representative's attention to such deviations at the time of submission, and the OWNER or their representative has given written concurrence to the specific deviations; nor shall any concurrence by the OWNER or their representative relieve CONTRACTOR from responsibility for errors and omissions in the submittals. Concurrence of the CPM Activity Network by the OWNER or their representative is advisory only and shall not relieve the CONTRACTOR of responsibility for accomplishing the Work within the Contract Completion Date(s).

D. Concurrence, acceptance, or approval of the CONTRACTOR's CPM schedule by the OWNER or their representative in no way makes the OWNER or their representative an insurer of the CPM schedule's success, nor liable for time or cost overruns resulting therefrom.

E. Failure to include any element of Work required for the performance of this Contract will not excuse the CONTRACTOR from completing all Work required within the Contract completion date(s), notwithstanding the review of the network by the OWNER or their representative.

F. CPM schedules that contain activities with negative float, or which extend beyond the Contract Completion Date, will not be acceptable.

G. Except where earlier completions are specified, CPM schedules which show completion of all Work prior to the Contract Completion Date may be indicated; however, in no event shall they constitute a basis for claim for delay by the CONTRACTOR.

PART 3 EXECUTION

3.01 IMPLEMENTATION SCHEDULE

A. Baseline (as-planned) Schedule

1. Within 21 days following the receipt of the Notice to Proceed, submit a Baseline Schedule that incorporates any comments received from the OWNER or their representative in the pre-construction meeting.

2. Upon concurrence, acceptance, or approval of the CONTRACTOR's initial Baseline Schedule, statused as of the Notice to Proceed date, it shall be recognized as the basis against which the CONTRACTOR's progress shall be measured.

B. Monthly Status Reports

1. Monthly Status Reports shall include updated graphics and a narrative, as requested. In addition, if requested by the OWNER or their representative, CONTRACTOR shall provide copies of one or more of the standard reports listed in 2.3.B.

2. The CONTRACTOR shall provide Monthly Status Reports (schedule updates) unless approved otherwise by the OWNER or their representative. The Monthly Status Reports shall be statused as of the end of each calendar month.

3. Once the initial Baseline Schedule is complete, Monthly Status Reports shall be based on the Baseline Schedule.

3.02 DELIVERABLES

A. Unless approved otherwise by the OWNER or their representative, the initial Baseline Schedule shall be printed in color on sheets 24-inches x 36-inches, and may be divided into as many separate sheets as required. For monthly status reports, the schedules shall be printed in color on sheets 11-inches x 17-inches.

B. Baseline Schedule: Submit one (1) electronic copy (PDF), two (2) color (24-inch x 36-inch sheets) hardcopies, and a copy of the program files to the OWNER or their representative.

C. Monthly Status Reports: Submit one (1) electronic copy to the OWNER or their representative with the Monthly Request for Payment.

3.03 PROGRESS REPORTING

A. Progress under the approved CPM schedule shall be reported monthly by the CONTRACTOR by submitting a Monthly Status Report. Unless otherwise approved by the OWNER or their representative, not less than 7 days prior to the due date of the Monthly Status Report, the CONTRACTOR shall meet with the OWNER or their representative to jointly evaluate the status of each network activity.

Each activity shall be updated to reflect the actual progress (percent complete) and the actual dates activities were started and completed, as applicable.

B. The Monthly Status Report shall include an update of the computer-generated network graphics and a narrative report. The narrative shall include:

1. A description of the progress during the reporting period in terms of completed activities.

2. A summary of the Critical Path.

3. A description or explanation of each delay to network activities.

4. A description of problem areas, current and anticipated delaying factors, and their anticipated effect on the performance of other activities and completion dates.

5. An explanation of corrective action taken or proposed.

6. This report, as well as the CPM Status Report, will be discussed at each progress meeting.

3.04 RESPONSIBILITY FOR SCHEDULE COMPLIANCE

A. Whenever it becomes apparent from the current CPM schedule and CPM Status Report that delays to the critical path have resulted and the Contract Completion Date will not be met, or when so directed by the OWNER or their representative, take some or all of the following actions, at no additional cost to the OWNER. Submit to the OWNER or their representative for approval, a written statement of the steps intended to take to remove the delay(s) to the critical path in the approved schedule.

1. Increase construction manpower in such quantities and crafts,

2. Increase the number of working hours per shift, shifts per day, working days per week,

3. Increase the amount of construction equipment, and/or

4. Reschedule activities to maximize the concurrence of activities and comply with the revised schedule.

B. If, when so requested by the OWNER or their representative, the CONTRACTOR fails to submit a written statement of the steps intended to take, or fails to take such steps as approved by the OWNER or their representative, the OWNER or their representative may direct the CONTRACTOR to increase the level of effort in man-power (trades), equipment and Work schedule (overtime, weekend and holiday work, etc.) to be employed by the CONTRACTOR in order to remove the delay(s) to the critical path in the approved schedule, and the CONTRACTOR shall promptly provide such level of effort at no additional cost to the OWNER.

3.05 ADJUSTMENT OF CONTRACT SCHEDULE AND COMPLETION TIME

A. If the CONTRACTOR wants or needs to make changes in execution of the construction schedule that would affect the approved CPM schedule, the CONTRACTOR shall notify the OWNER or their representative in writing, stating what changes are proposed and the reasons for the changes. If the OWNER or their representative approves such changes, the CONTRACTOR shall revise and submit a revised schedule for approval, without additional cost to the OWNER. The CPM schedule shall be adjusted by the CONTRACTOR only after prior approval of proposed changes. Adjustments may consist of changing portions of the activity sequence, activity durations, division of approved activities, or other adjustments as may be approved by the OWNER or their representative; however, the addition of extraneous, non-working activities and activities that add unapproved restraints to the CPM schedule will not be allowed.

B. The Contract completion time will be adjusted only for causes specified in this Contract. In the event the CONTRACTOR requests an extension of any Contract Completion Date, the CONTRACTOR shall furnish such justification and supporting evidence as the OWNER or their

representative may deem necessary to determine whether the CONTRACTOR is entitled to an extension of time under the provisions of this Contract. After receipt of such justification and supporting evidence, the OWNER or their representative shall perform an assessment or evaluation of the appropriate change in Contract time, based upon the currently approved CPM schedule and on all data relevant to the extension. Inexcusable delays (attributable to the CONTRACTOR) and non-critical delays (delays to activities which, according to the CPM schedule, do not affect any Contract Completion Date shown by the Critical Path) shall not be the basis for a change in Contract time. The OWNER or their representative will provide a written recommendation to the CONTRACTOR. The CONTRACTOR shall not change any fixed Contract milestones or required Completion Dates without the approval of the OWNER or their representative, evidenced by the execution of a Contract Change Order. However, the CONTRACTOR should make note of such requests for changes in Contract time in the narrative of monthly schedule status reports.

C. Each request for change in any Contract Completion Date shall be submitted by the CONTRACTOR to the OWNER or their representative in accordance with the notification requirements stipulated in the form of Contract or general conditions. No time extension will be granted for requests that are not submitted in accordance with the Contract requirements.

END OF SECTION

SECTION 01 32 13
CONTROL OF WORK

PART 1 GENERAL

1.01 CARE AND PROTECTION OF PROPERTY

A. Be responsible for the preservation of all public and private property and use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the CONTRACTOR, restore such property to a condition similar or equal to that existing before the damage was done, or make good the damage in other manner acceptable to the OWNER.

1.02 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. Assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables, whether or not they are shown on the Drawings. Carefully support and protect all such structures and utilities from injury of any kind. Immediately repair any damage resulting from the construction operations.

B. The CONTRACTOR shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines and sewers). Maintain services to buildings and pay costs or charges resulting from damage thereto.

C. Notify all utility companies in writing at least 72 hours (excluding Saturdays, Sundays and legal holidays) before excavating in any public way.

1.03 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the CONTRACTOR may be allowed to use water without charge for construction purposes.

B. The express approval of the OWNER shall be obtained before water is used. Waste of water shall be sufficient cause for withdrawing the privilege of unrestricted use. Hydrants shall only be operated under the supervision of the OWNER's personnel.

1.04 EQUIPMENT SALVAGE

A. Provide OWNER first right of refusal on all salvageable materials and equipment to be removed from the existing building systems and processes. Dispose of all other materials and equipment off-site and as required by state and local regulations. Reference Section 02 41 19 for demolition and removal of existing infrastructure.

1.05 REFERENCES

A. Throughout these specifications there are references to various standards and codes. CONTRACTOR shall use the most current edition of specified standards and codes (as amended by the Municipality of Anchorage), whether these are specifically noted within the specifications or not.

1.06 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

A. During the course of the Work, keep the site of operations as clean and neat as possible. Dispose of all residue resulting from the construction work and, at the conclusion of the Work, remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and leave the entire site of the Work in a neat and orderly condition.

B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, comply with all applicable federal, state, and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and in other related Sections.

C. Disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited. Any violation of this restriction by the CONTRACTOR or any person employed by him will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The CONTRACTOR will be required to remove the fill and restore the area impacted at no increase in the Contract Price.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 13
SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 EXISTING WATER TREATMENT PLANT OPERATION

A. CONTRACTOR is cautioned that the Work is being performed on the site of a wastewater treatment plant that operates as the primary treatment facility for the Girdwood Area. For this reason, the CONTRACTOR shall cooperate at all times with the OWNER in order to maintain plant operation with the least amount of interference and interruption possible.

B. The CONTRACTOR's schedule, plan and Work shall, at all times, be subject to alteration and revision if necessary to maintain plant operations.

1.02 SERVICES OF MANUFACTURERS' FIELD SERVICE TECHNICIAN

A. Lump Sum bid for equipment furnished under this Contract shall include the cost of a competent field service technician of the manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment, and to instruct the OWNER's operating personnel on operation and maintenance. The approved manufacturer's operation and maintenance data shall be delivered to the OWNER or their representative prior to training the OWNER's personnel.

B. After installation of the equipment has been completed and the equipment is ready for operation, but before it is operated by others, the manufacturer's field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points, where applicable:

1. Soundness (without cracked or otherwise damaged parts)

2. Completeness in all details, as specified and required

3. Correctness of setting, alignment and relative arrangement of various parts

C. Upon completion of this Work, the manufacturer's field service technician shall submit to the OWNER or their representative a complete, signed report of the results of the inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained, if such are specified, and suggestions for precautions to be taken to ensure proper maintenance.

D. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of the unit, shall be submitted prior to the startup and performance demonstration hereinafter specified. The certificate shall indicate date and time instruction was given and names of operating personnel in attendance. See Section 01 46 50 for manufacturer’s Certificate of Installation form.

1.03 GREASE, OIL, FUEL, AND TESTING EQUIPMENT

A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. All equipment and tools required for testing of equipment shall be furnished by the

CONTRACTOR, the cost of which shall be borne by the CONTRACTOR. The OWNER shall be furnished with a year's supply of required lubricants, including grease and oil of the type recommended by the manufacturer, with each item of equipment supplied under this Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 46 50
INSTALLATION, TESTING, AND TRAINING REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general installation procedures, inspection requirements, factory and field testing procedures, start-up, commissioning, training, and tools and spare parts.

B. Testing shall demonstrate, to the satisfaction of the OWNER or their representative, that each system has the capability to provide local control of all system functions and to interface with the OWNER's plant wide SCADA system (Plant Control System – PCS) for complete remote control and monitoring, as specified in these Contract Documents.

C. Unless otherwise specified in the Contract Documents, the CONTRACTOR shall be responsible to fulfill these requirements.

1.02 DEFINITIONS

A. Roles

1. CONTRACTOR: The CONTRACTOR and/or their subcontractors performing the Work of this Contract.

2. Design ENGINEER: ENGINEER of record for the design under separate contract to OWNER.

3. OWNER: The Anchorage Water and Wastewater Utility (AWWU) or their representative(s).

4. OWNER's SCADA System Integrator: A SCADA System Integrator under separate contract to OWNER who deals primarily with monitoring and control functionality between the existing SCADA system and equipment furnished under this Contract.

B. Responsibilities

1. Assist (A): Provide assistance to those primarily responsible for leading the performance of identified installation, testing, and training activities, including active participation in their planning and execution as necessary to complete the Work.

2. Lead (L): Hold primary responsible for completing the identified installation, testing and training activities.

3. Support (S): Provide support for identified installation, testing and training activities by making equipment, systems, and personnel available to those primarily responsible for leading identified activities. Support of task primarily includes allocating sufficient time in the construction schedule for supporting activities with equipment, systems and personnel for which others are primarily responsible for leading.

4. Witness (W): Participate in identified installation, testing and training activities as an observer.

C. Testing Activities

1. Factory Acceptance Testing (FAT) or Shop Witness Testing: Quality control testing conducted at the source or point of assembly to demonstrate components, devices, equipment/systems, and software meets specified performance requirements prior to shipment.

2. Testing shall occur following proper installation of equipment, including Component Testing, System Testing and Operational Testing:

   a. Component Testing: Testing to demonstrate that component is installed properly and meets the requirements of the Contract Documents, including documentation of certificate(s) of installation. For equipment related to instrumentation and controls, or consisting of wiring/cabling, individual loop checks and verification of 'point-to-point' functionality shall be conducted as part of Component Testing.

   b. System Testing: Testing performed on a complete subsystem or system to demonstrate that equipment/system meets manufacturers' calibration and adjustment requirements and other requirements as specified, including complete functionality. System testing includes operating equipment/system manually in local, manually in remote (or remote manual), and automatically in remote (in remote auto).

   c. Operational Testing: Testing performed on complete systems, which include full operation over specified performance durations in conditions that match the intended operating conditions (e.g., using plant water for operational testing). This is distinguished from start-up and commissioning in that the OWNER's SCADA System Integrator and CONTRACTOR are jointly operating the equipment during operational testing to demonstrate its readiness for start-up and operation by the OWNER.

3. Table 01 46 50-1 below generally describes the responsibilities of each role identified above during each activity. The table is provided for convenience and does not relieve the CONTRACTOR of additional installation, testing and training requirements included in individual technical specification sections

1.03 RELATED WORK

A. Delivery, storage and handling requirements are specified in Section 01 60 00.

B. Performance, system testing, and additional training, where required, is specified in the individual equipment sections.

C. Operating and Maintenance Data is included in Section 01 78 36.

TABLE 01 46 50-01 – ROLES AND RESPONSIBILITIES FOR INSTALLATION, TESTING, AND TRAINING REQUIREMENTS

	OWNER	Design Engineer	OWNER's SCADA System Integrator	CONTRACTOR or Subcontractor
PLANT CONTROL SYSTEM - PLC, SCADA, HMI PROGRAMMING				
Plant PLC Programming	A		L	S
Plant Remote I/O Configuration	A		L	A
HMI Screen Development for Control Room & Distributed (iFix) SCADA Terminals	A		L	S
Blower PLC Logic and local Operator Interface (OI) Graphics	A		L	A
NETWORK INTERFACES				
EtherNet Interface between Blower PLC and Plant SCADA System	A		L	S
FACTORY ACCEPTANCE TESTING				
Factory Acceptance Testing for Blowers	W	W	W	L
INSTRUMENTS				
Instrument Data Sheets (Submittal for Review and Approval)				L
Loop Check, Configuration, and Calibration	W			L
FIELD TESTING OF BLOWER SYSTEM				
Component Testing (Component Functional Testing and Component I/O Coordination and Configuration)		A	A	L
Component Testing Sign-off Forms		W		L
System Testing (System Functional Testing)		A	A	L
System Testing Sign-off Forms		W		L
Operational Testing (Testing with Raw Water)	S	A	L	A
Operational Testing Sign-off Forms	S	W	L	A
OWNER TRAINING				
Equipment Training by Blower Rep	W	W		L
Plant SCADA System Training (New and Modified Systems)	W	W	L	A

KEY: **A** = ASSIST, **L** = LEAD, **S** = SUPPORT, **W** = WITNESS

1.04 SUBMITTALS

A. Submit, in accordance with Section 01 30 00, the following, at a minimum:

1. Qualifications and credentials for the CONTRACTOR's proposed field personnel responsible to coordinate installation, testing, commissioning, and training, at least 45 days in advance of the need for such services.

2. Detailed testing procedures for field tests. Submittals shall be submitted at least 45 days in advance of the proposed test dates and shall include the following information, at a minimum:
   a. Name, classification, model and serial number of equipment to be tested, including reference to specifications section number and title.
   b. Testing schedule of proposed dates and times for testing.
   c. Summary of power, lighting, chemical, water, service air, etc., needs requested from the OWNER.
   d. A written outline of the specific assignment of the responsibilities of the CONTRACTOR and manufacturers' factory representatives or field service personnel.

e. Detailed description of step-by-step testing requirements, methodology, metrics, sampling points, and measured parameters, with reference to appropriate standardized testing procedures and laboratory analyses by established technical organizations (e.g., ASTM, APHA, AWWA, WEF, etc.).
f. Proposed forms to be used to collect and record test data and to present tabulated test results, and to be used for sign-off by OWNER.

3. Copies of test reports upon completion of specified factory, field, and other tests. Reports shall be submitted within 14 days after completion. Reports shall incorporate the information provided in the test procedures submittals as modified to reflect actual conduct of the tests and the following additional information:
   a. Copy of all test data sheets and results of lab analyses.
   b. Summary comparison of specified test and performance requirements versus actual test results.
   c. Should actual test results fail to meet specified test and performance requirements, describe action to be taken prior to re-testing the equipment.

B. Operating and Maintenance Data

1. A training schedule and syllabus shall be submitted not less than 14 days prior to the start of the commissioning period.

2. No less than 5 days prior to the start of training, five (5) copies of all training materials shall be submitted in electronic format.

3. Operating and maintenance (O&M) instructions shall be furnished to the OWNER. The instructions shall be prepared specifically for this installation and shall include all information to instruct O&M personnel unfamiliar with such equipment. O&M data shall be submitted in accordance with Section 01 78 36.

1.05 QUALITY ASSURANCE

A. The CONTRACTOR shall provide skilled field personnel to support installation, inspection, start-up, testing, commissioning, and trouble-shooting to deliver fully functional, installed and commissioned systems. Roles and qualification requirements shall be as specified below. Manufacturers' sales and marketing personnel will not be accepted in these roles unless they can prove their qualifications.

1. Testing, Commissioning and Start-Up Supervisor: Professional experience in the proper installation, operation, control, trouble-shooting, field testing and commissioning of process mechanical equipment, including at least three (3) installation and start-up projects over the past 5 years.

2. Trainer: Trainer must be familiar with the equipment for which training is being conducted, must have professional experience in training of plant operations, including providing on-site training on at least three (3) similar projects over the past 5 years, and must have demonstrated experience with water treatment facility operation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The CONTRACTOR's field personnel shall complete equipment installation, inspection, testing and start-up general requirements, as specified herein and elsewhere in these Contract Documents.

B. All tests, inspections, and training shall be conducted during the work week of Monday through Friday, unless otherwise specified.

3.02 INSPECTION REQUIREMENTS

A. After installation of the equipment has been completed and the equipment is presumably ready for operation, the equipment supplier and CONTRACTOR shall jointly inspect, operate and adjust the equipment. The inspection shall include at least the following points, where applicable:

1. Soundness (without cracks, leaks, or otherwise damaged parts).

2. Completeness in all details, as specified and required.

3. Correctness of setting, alignment and relative arrangement of various parts.

4. Adequacy and correctness of packing, sealing and lubricants.

B. The operation and adjustment shall be as required to prove that the equipment has been left in proper condition for safe and satisfactory condition and is ready for testing and operation under the conditions specified.

3.03 FIELD TESTING

A. General

1. Field tests shall consist of the following tests (in order): Component Tests, System Tests, Operational Tests.

2. System Tests are only required for specific equipment and systems, if specified elsewhere in these Contract Documents.

3. The CONTRACTOR shall have available sufficient personnel of relative trades to assist with field testing and trouble-shooting during testing.

4. Field tests shall be documented by the CONTRACTOR and submitted to the OWNER to verify that all stated equipment and controls are in the working condition specified.

5. The CONTRACTOR shall document all equipment servicing during both the pre-warranty and warranty periods.

6. Any defects in the equipment or controls, or failure to meet any requirements of the Specifications, shall be promptly corrected by the CONTRACTOR at no additional cost to the OWNER.

7. Any defects in installation, alignment and assembly shall be promptly corrected to the manufacturer's specifications by the CONTRACTOR at no cost to the OWNER.

8. The OWNER will provide power, water, service air, consumables, and other utilities, as required, for operating during testing, and as reasonably requested by the CONTRACTOR no less than 96 hours prior to commencing testing.

9. Any additional time required to satisfactorily complete all required testing activities and to achieve Substantial Completion shall be borne by the CONTRACTOR.

10. In the event of any interruption of any test run, caused by the OWNER, the test shall be restarted from the point of interruption and run for the remaining duration.

B. Component Testing - Mechanical

1. Mechanical component tests are those tests intended to confirm mechanical operation for a piece of equipment.

2. Equipment supplier shall conduct a mechanical test and document and submit to the OWNER results of tests for each installed piece of equipment. The mechanical tests shall demonstrate that each unit or component within the system:

   a. Has not been damaged by transportation or installation.
   b. Has been properly installed.
   c. Has no mechanical defect.
   d. Is free of overheating of any parts.
   e. Is free of objectionable vibration.
   f. Is free of overloading of any parts.
   g. Is free of excessive noise.
   h. Has all internal and hard-wired interlocks operating correctly.

3. Equipment supplier shall mechanically test all major pieces of equipment and systems with the assistance of the CONTRACTOR.

C. Component Testing – Instrumentation & Controls (I&C)

1. I&C Component tests are those tests intended to test wiring and signal communication.

2. Components (e.g., equipment, instruments, valves, and other devices with electric power and/or I/O) shall be tested to confirm that they are fully functional to meet or exceed the specified requirements. Tests shall cover the full operational range or capability of each component and shall include, but not be limited to:

   a. Signal verification (check or correct voltages, I/O point test, current polarity, contact "sensor", etc.).
   b. Database verification (check for correct range, alarm limits, message repairs, etc.).
   c. Operator input to the component locally.

3. All instruments and controls shall be calibrated through their full range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made.

D. System Testing

1. Integrated System Tests are those tests intended to test logic, software interlocks, PLC programming, SCADA communication, and automated system controls of fully installed and integrated systems.

2. Complete systems shall be tested by the CONTRACTOR to confirm that the system operates cohesively to meet or exceed the specified requirements. Tests shall cover the full system operational range or capability, all operational modes, and shall include, but not be limited to:

   a. Operator input through SCADA to the local control panel and PLC.
   b. Component and PLC output to SCADA.
   c. Verification of application software and programming.
   d. Historian.
   e. Alarm log and display generation.
   f. Man-machine interface.

3. All field instrumentation and controls that are an integral part of a given system being tested shall also be tested simultaneously.

4. Testing shall demonstrate, to the satisfaction of the OWNER, that the equipment has the capability to provide local automated control of all system functions and to interface with the OWNER's plant wide SCADA system, as specified in these Contract Documents.

5. The integrated systems test shall demonstrate successful functioning of the system and all its elements and software capabilities through planned test cases with actual system on-line operating conditions.

6. All process and control functions shall be tested, as well as designated combinations and logical sequence.

7. Operation of I/O peripherals shall be checked out.

   a. The Control system response to the instrument signals shall be tested. The expected and observed behavior shall be documented for the purposes of the test. Analog instruments shall be observed at 5% of useful range, 50% of useful range, 95% of useful range, and open loop (to simulate a device failure). Useful range shall be the lowest possible physically measured value to the highest possible physically measured value. Discrete instruments shall be tested in the actuated and non-actuated states.

8. During the integrated system test, the CONTRACTOR shall demonstrate that the system can function continuously and reliably in accordance with the specifications.

9. The CONTRACTOR shall notify the OWNER at least ten (10) working days prior to all integrated systems tests.

E. Operational (Performance) Testing

1. General
   a. Operational testing activities will be led by the OWNER's SCADA System Integrator and shall be conducted after successful completion of mechanical/component tests and

integrated system tests, where applicable, to ensure that all equipment is individually in acceptable operating condition, calibrated, and ready for operational testing.

b. Unless otherwise specified, operational testing shall consist of at least one, 8-hour day of operation.

c. The CONTRACTOR is responsible to facilitate activities to operate the facility in a manner which subjects equipment to conditions within the maximum allowable operating conditions for which the equipment was designed, and the manufacturer's recommendations, whichever is more stringent.

3.04 WITNESS REQUIREMENTS AND OUT OF STATE TRAVEL

A. Factory acceptance tests (FATs) or shop factory tests will be witnessed by the OWNER and/or OWNER's representatives, as required by the various equipment specifications. Three (3) week notice shall be given by the CONTRACTOR to the OWNER prior to the start of factory testing.

B. For out of state travel to witness factory testing, the cost of one (1) representative from the OWNER shall be included in the CONTRACTOR's Lump Sum bid. The cost shall include airfare, ground transportation, and lodging for the duration of FAT. Meals are excluded.

3.05 VENDOR TRAINING/INSTRUCTION (TO OWNER'S PERSONNEL)

A. Before final initiation of operation, CONTRACTOR's vendors shall train/instruct OWNER's designated personnel in the operation, adjustment, and maintenance of products, equipment and systems at times convenient to the OWNER.

B. Unless specified otherwise under the respective equipment specification section, vendor training/instruction shall consist of 4 hours of training for each type of equipment. Such training/instruction shall be scheduled and held at times to accommodate the work schedules of OWNER's personnel, including splitting the required training/instruction time into separate sessions and/or presented at reasonable times other than the CONTRACTOR's "normal working hours" or the OWNER's normal day shift.

C. Use operation and maintenance manuals as basis for instruction. Train/instruct the OWNER's personnel, in detail, based on the contents of manual explaining all aspects of operation and maintenance of the equipment. If the respective equipment is inter-related to the operation of other equipment, all interlocks, constraints, and permissives shall be explained.

D. At least 14 days prior to the schedule for vendor training, a detailed lesson plan, representative of the material to be covered during instruction, shall be submitted to the ENGINEER for approval. Lesson plans shall consist of in-depth outlines of the training material, including a table of contents, resume of the instructor, materials to be covered, start-up procedures, maintenance requirements, safety considerations, and shut-down procedures.

E. Prepare and insert additional data in each Operation and Maintenance Manual when the need for such data becomes apparent during training/instruction.

3.06 VIDEOGRAPHY OF VENDOR TRAINING/INSTRUCTION

A. Audio/video (A/V) record (in DVD format) training/instructions as they are being provided to the OWNER's personnel. Such recording shall include the entire training/instruction session(s), as well as all questions and answers. A/V recording shall be performed by a professional

organization experienced in the production of such recordings. Self-recording by the CONTRACTOR may be considered, provided that the CONTRACTOR can demonstrate, in advance, proficient examples of such recordings.

B. To avoid audio problems, training/instruction shall be held in a location sufficiently removed from construction activity, insulated from the noise of construction activity, or during a time when construction activity is not occurring in the vicinity.

C. The audio portion of the A/V recording should be done with a microphone (wired or wireless) attached to the trainer/instructor to maximize the quality of speech.

D. Each A/V recording should have "chapters" to segregate the distinct portions of the training/instruction, or have visual cues at the start of a change in subject.

E. Two copies of the A/V recordings shall be submitted to the OWNER or their ENGINEER on DVD disk(s). The DVDs will become the property of the OWNER.

3.07 TOOLS AND SPARE PARTS

A. Furnish one set of special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation and maintenance of any equipment with the respective equipment.

B. Furnish spare parts and grease to assure normal running and maintenance for a period of 2 years, as recommended by the equipment manufacturer.

3.08 STARTUP, SCADA INTEGRATION AND COMMISSIONING PHASE

A. General Requirements

1. Start-up and commissioning shall not commence until the CONTRACTOR has verified to the OWNER that:
   a. All field testing has been satisfactorily completed.
   b. All specified safety equipment has been installed and is in good working order.
   c. All lubricants, tools, maintenance equipment, spare parts and approved equipment O&M manuals have been furnished as specified.
   d. The required training of the OWNER’s personnel has been completed.
   e. All equipment, instrument, and valve tagging is complete.

2. The CONTRACTOR shall coordinate with OWNER’s SCADA System Integrator to successfully execute the step-by-step procedure of startup, normal operation, shutdown, and performance demonstration specified herein.

3. The CONTRACTOR shall document startup and performance demonstration prior to Substantial Completion and acceptance by the OWNER of the new or modified systems.

B. Preparation for Startup

1. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. All systems shall be cleaned and purged as required.

2. All pipelines which were hydraulically checked shall be drained and returned to their original condition once the testing is complete.

C. Refer to Section 01 14 00 for:

1. Project schedule allowance for SCADA System Integration by OWNER's SCADA System Integrator.

END OF SECTION

FORM 01 46 50 CERTIFICATE OF INSTALLATION

Owner_____

Project _____

Contract No._____

Equipment Specification Section _____

Equipment Description _____

Equipment Tag Nos. _____

I,_____, Authorized representative of
(*Print Name*)

_____
(*Print Manufacturer's Name*)

the undersigned manufacturer's representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate this equipment/system and (iii) authorized to make recommendations required to assure that the equipment/system furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

I hereby CERTIFY that

_____
(*Print equipment name, tag no., and model with serial no.*)

installed for the subject project has (have) been installed in a satisfactory manner, has (have) been tested and adjusted, and is (are) ready for final acceptance testing and operation on :

Date_____ Time_____

This is evidenced in the attached documents (check all that apply):

_____ Field test results with collected data and test report.

_____ Laboratory sampling and analytical testing report.

_____ Written certification report prepared by and signed by the electrical and/or instrumentation subcontractor.

CERTIFIED BY: _____ _____
(*Print Name*) (*Manufacturer's Representative Signature*)

Signature Date:_____

FORM 01 46 50B CERTIFICATE OF FACTORY ACCEPTANCE TESTING (FAT)

OWNER _____ EQPT/SYSTEM _____

PROJECT NAME _____ EQPT TAG NO. _____

PROJECT NO. _____ EQPT SERIAL NO. _____

SPECIFICATION NO. _____ SPECIFICATION TITLE_____

Comments:

_____

_____

_____

_____

_____

I hereby certify that Factory Acceptance Testing (FAT) was performed on the above-referenced equipment/system as defined in the Contract Documents and results conform to the Contract Document requirements (see attached testing data/forms).

Date of Execution:_____, 20___

Manufacturer: _____

Manufacturer's Authorized Representative Name *(print):* _____

_____

Authorized Representative (*signature*)

Witness #1 (Owner Representative) _____

Witness #1 Name (*print*)

_____

Witness #1 Name (*signature*)

Witness #2 (Owner Representative) _____

Witness #2 Name (*print*)

_____

Witness #2 Name (*signature*)

SECTION 01 51 00
TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, materials, and incidentals necessary and provide separate temporary facilities for the CONTRACTOR's use and/or use by Construction Manager (CM) personnel, as specified herein.

B. Operate and maintain temporary facilities for the duration of the Project and as directed by the OWNER or their representative. All cost and use charges for temporary facilities shall be included in the CONTRACTOR's Lump Sum bid.

1.02 SUBMITTALS

A. Submit shop drawings and product data, in accordance with Section 01 30 00, showing materials of construction and details of installation for:

1. Site Plan: Show the proposed locations for temporary facilities, including storage containers/buildings, vehicle access and parking areas, material laydown and staging areas, temporary fencing, maintenance and access routes, snow storage, and security measures.

B. Submittals shall be received by the OWNER or their representative no later than the date of the pre-construction meeting.

1.03 QUALITY ASSURANCE

A. Temporary facilities shall comply with all applicable state and local ordinances, codes and regulations.

B. Coordinate with authorities having jurisdiction to inspect (and test if required) temporary facilities.

1.04 DEFINITIONS

A. Duration of the Project: The period of time from the date of the Notice to Proceed to the date of Final Acceptance (inclusive).

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Fire Extinguishers: Provide portable, UL-rated with class and extinguishing agent required by locations and classes of fire exposure.

PART 3 EXECUTION

3.01 SANITARY FACILITIES FOR CONTRACTOR'S USE

A. Provide self-contained, single occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed in a fiberglass or other approved non-absorbent shell.

3.02 CONSTRUCTION AIDS

A. Provide temporary hoists, cranes, scaffolding and platforms as necessary to perform the Work. Provide temporary stairs where ladders are not adequate. Protect permanent stairs from damage from construction operations.

3.03 VEHICLE ACCESS AND PARKING

A. Use existing paved access roads while on plant site. Use designated parking areas will be provided to the CONTRACTOR by the OWNER or their representative.

B. Clear snow and ice from all drives, walks, and stairs to maintain safe access to the GWWTF as directed by the OWNER or their representative.

3.04 WASTE MANAGEMENT

A. Provide separate covered dumpster of adequate size for construction debris. Empty dumpsters on a regular basis. Dumpsters shall not exceed their capacities at any time.

END OF SECTION

SECTION 01 60 00
DELIVERY, STORAGE AND HANDLING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the general requirements for the delivery handling, storage and protection for all items required in this Project. Specific requirements, if any, are specified with the related item.

B. Terminology used herein refers to the following:
   1. Supplier: The entity with unit responsibility for furnishing a piece of equipment, component, or package system to the CONTRACTOR as specified in these Contract Documents.

1.02 SUBMITTALS

A. Submit fully executed Delivery Inspection Forms within 3 business days of the arrival and inspection of delivered shipments. Delivery Inspection Form can be found at the end of this Section.

B. Special shipping, storage and protection, and handling instructions for individual pieces of equipment or packages shall be submitted as part of the technical submittal information for that piece of equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION FOR SHIPMENT

A. All surfaces of equipment, both interior and exterior, shall be cleaned of grease, chips, dirt and other foreign material. Threaded connections shall be inspected and irregularities corrected. Threads shall be given a rust preventative coating and shall be protected from damage. Openings shall be closed with substantial covers and waterproof paper, or equivalent, for shipment. Machined surfaces such as flange faces, shafting, etc., shall be coated with a suitable rust preventative material which can be readily removed but which shall withstand weather elements in shipment. Exposed machined surfaces shall be protected by wood block, wood covers, or other means to prevent damage in transit and handling.

B. Special handling instructions shall be conspicuously placed on all equipment requiring unusual handling or shipping care.

C. All parts shall be marked for identification.

D. After the equipment has been prepared for shipping, each shipping unit shall be plainly marked by stencil or equivalent with the Contract number, the piece mark number, and the weight.

E. All contents of shipment containers (boxes, crates, packages, etc.) shall be clearly identified in the *Bill of Materials* included with each shipment.

F. Each item, or part of an item shipped separately, shall be identified with a weatherproof tag showing the item name and equipment number as specified in these Contract Documents, and area number.

3.02 TEMPORARY STORAGE

A. The CONTRACTOR shall be responsible for all storage of furnished equipment until delivery to the Project site.

B. All furnished equipment shall be handled and stored in accordance with the manufacturer's written recommendations and in a manner to prevent damage.

C. CONTRACTOR to coordinate with OWNER to accommodate temporary storage of equipment provided for the Project inside water treatment plant building.

3.03 TRANSPORTATION AND DELIVERY

A. Shipping destination and labeling shall be as follows:

Girdwood Wastewater Treatment Facility
238 Ruane Drive
Girdwood, Alaska 99587

B. The equipment shall be shipped in a completely enclosed weatherproof container. The container shall be clearly labeled on all sides.

C. The CONTRACTOR is responsible to ensure that accelerometers have been included in shipments where specified in these Contract Documents. The OWNER reserves the right to reject items that were shipped without an accelerometer where accelerometers were required.

D. System suppliers shall be responsible for transporting and handling all furnished items in accordance with manufacturer's instructions. All furnished system equipment shall be shipped in sections which are as large as practical, to minimize field assembly.

E. CONTRACTOR shall obtain all necessary permits and approvals to deliver the products to the Project site, and shall be responsible for any fees associated with same.

F. All protective coverings and restraints required to secure and transport the products shall be provided by the supplier.

G. CONTRACTOR shall plan shipping times and shall account for the impacts of over-sized loads, road construction, shipping traffic volumes, and weight restrictions. Prior to shipment, the CONTRACTOR shall investigate conditions of the transportation facilities, such as clearances; restrictions, barge, bridge, and road load limits, construction at shipping hubs, and other limitations which may impact shipping. Any such limitations of the transportation facilities shall not become the basis for claims or damages against the OWNER for extension of time for completions of the Work or delivery.

H. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.

3.04 DELIVERY INSPECTION

A. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the OWNER's normal operation and will not interfere with the flow of necessary traffic.

B. CONTRACTOR is responsible to have suppliers present on site to witness and inspect delivery of shipments for selected equipment and to complete the *Delivery Inspection Form*, wherever required, as specified in these Contract Documents.

C. Damage to the products, or loss of products during shipment and prior to unloading and transfer of products to the CONTRACTOR, shall be repaired or replaced at no additional cost to the OWNER. The supplier shall expedite replacement of damaged, incomplete, or lost items.

END OF SECTION

FORM 01 60 00 DELIVERY INSPECTION FORM

Supplier: _____(entity name)
Supplier's Contact Individual:_____(name)
Manufacturer:_____(name)
Description: _____
Delivery Date: _____
Subcontractor: _____(name)

This is to certify that the Supplier and CONTRACTOR have jointly inspected the below-described materials and/or equipment and have not observed any physical damage except as noted. Where damage is noted, a remedy plan must be identified below.

_____
_____
_____
_____
_____

Date of Delivery:_____Time:_____

Signing this document transfers responsibility from the Supplier to the CONTRACTOR. From this date on, the CONTRACTOR is responsible for these materials and/or equipment.

Signatures:

CONTRACTOR: _____ Title: _____

Date: _____

Subcontractor: _____ Title: _____

Date: _____

Supplier: _____ Title: _____

Date: _____

Tag No.	Qty Order	Qty Received	Unit/ Matl.	Box#	Dwg#	Vendor#	Description	Truck

COMMENTS:

_____
_____
_____

SECTION 01 74 23
CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions or directed by OWNER or their representative.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 DISPOSAL AND CLEANING

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations and anti-pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the Work, the site, and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workers for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other foreign materials from sight-exposed interior and exterior surfaces.

C. Wash and shine glazing and mirrors.

D. Polish glossy surfaces to a clear shine.

E. Ventilating Systems:

1. Clean permanent filters and replace disposable filters if units were operated during construction.

2. Clean ducts, blowers and coils if units were operated without filters during construction.

F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

G. Prior to final completion or OWNER occupancy, conduct an inspection of sight-exposed interior and exterior surfaces and all Work areas, to verify that the entire Work area is clean.

END OF SECTION

SECTION 01 77 10
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies administrative, verification, and procedural requirements for Project closeout.

1.02 CLOSEOUT PROCEDURES

A. Provide all deliverables, as specified, prior to submitting the Final Payment Application, including:

1. Approved submittals
2. O&M Manuals
3. Record drawings
4. Warranties and bonds
5. MAXIMO equipment summary forms

B. Provide submittals to the OWNER or their representative that are required by governing or other authorities having applicable jurisdiction, including, but not limited to, permit close out information, certificates of occupancy, etc.

C. Submit Application for Final Payment identifying total adjusted Contract Sum, previous payments and sum remaining due.

D. Submit Contractor's Final Release and Release of Liens with Final Payment Application.

1.03 FINAL CLEANING

A. Contractor to complete final cleaning prior to submittal of the Final Application for Payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 78 36
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes procedural requirements for compiling and submitting operation and maintenance (O&M) data required to complete the Project.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 OPERATING MANUALS

A. Provide specific O&M instructions for all electrical, mechanical, and instrumentation and controls equipment furnished under various technical specifications Sections.

B. CONTRACTOR shall furnish electronic file of each manual that is complete with electronic bookmarks and hard-copy of each manual as described below.

C. Separate manuals shall be provided for each type of equipment, or each Section number.

D. Each manual shall contain the following:

1. Format and Materials
   a. Binders:
      1) Commercial quality three ring binders with durable and cleanable plastic covers.
      2) Maximum ring width capacity: 3 inches.
      3) When multiple binders are used, correlate the data into related consistent groupings/volumes.
   b. Identification: Identify each volume on the cover and spine with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". Include the following:
      1) Title of Project.
      2) Identify the general subject matter covered in the manual.
      3) Identify structure(s) and/or location(s), of the equipment provided.
      4) Specification Section number.
   c. 20 lb loose leaf paper, with hole reinforcement.
   d. Page size: 8-1/2-inch by 11-inch.
   e. Provide heavy-duty fly leafs (section separators), matching the table of contents, for each separate product, each piece of operating equipment, and organizational sections of the manual.
   f. Provide reinforced punched binder tab; bind in with text.
   g. Reduce larger drawings and fold to the size of text pages - but not larger than 11 inches by 17 inches; or provide a suitable clear plastic pocket (with drawing identification) for such folded drawings/diagrams.

2. Contents:
   a. A table of contents/Index, divided into sections reflective of the major components provided.
   b. Specific description of each system and components.
   c. Name, address, telephone number(s) and e-mail address(es) of vendor(s) and local service representative(s).
   d. Specific on-site operating instructions (including starting and stopping procedures).
   e. Safety considerations.
   f. Project specific operational procedures and recommended log sheet(s).
   g. Project specific maintenance procedures.
   h. Manufacturer's operating and maintenance instructions – specific to the Project.
   i. Copy of each wiring diagram.
   j. Copy of approved shop drawing(s) and CONTRACTOR's coordination/layout drawing(s).
   k. List of spare parts and recommended quantities.
   l. Product Data: Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Delete inapplicable information.
   m. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
   n. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.
   o. Warranties and Bonds, as specified in the General Conditions.

3. Transmittals
   a. Prepare separate transmittal sheets for each manual. Each transmittal sheet shall include at least the following: CONTRACTOR's name and address, OWNER's name, Project name, Project number, submittal number, description of submittal, and number of copies submitted.
   b. Submittals shall be transmitted or delivered directly to the office of the ENGINEER, as indicated in the Contract Documents, or as otherwise directed by the ENGINEER.
   c. Provide copies of transmittals only (i.e., without copies of the respective submittal) directly to the OWNER or their representative.

E. Manuals for Equipment and Systems - In addition to the requirements listed above, provide the following for each system:

1. Overview of system and description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include legible performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

2. Panelboard circuit directories including electrical service characteristics, controls and communications, and color-coded wiring diagrams as installed.

3. Operating procedures: include start-up, break-in and routine normal operating instructions and sequences; regulation, control, stopping, shut-down and emergency instructions; and summer, winter and any special operating instructions.

4. Maintenance Requirements
   a. Procedures and guides for trouble-shooting; disassembly, repair, and reassembly instructions.

b. Alignment, adjusting, balancing and checking instructions.
c. Servicing and lubrication schedule and list of recommended lubricants.
d. Manufacturer's printed O&M instructions.
e. Sequence of operation by instrumentation and controls manufacturer.
f. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

5. Control diagrams by controls manufacturer as installed (as-built).

6. CONTRACTOR's coordination drawings, with color coded piping diagrams, as installed (as-built).

7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams. Include equipment and instrument tag numbers on diagrams.

8. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.

9. Test and balancing reports, as required.

10. Additional requirements as specified in individual product specification.

11. Design data for systems engineered by the CONTRACTOR or its suppliers.

F. Electronic Transmission of O&M Manuals

1. Unless otherwise approved by the OWNER or their representative, O&M manuals may not be transmitted by electronic means other than by CD-ROM. Electronic O&M manuals shall meet the following conditions:
   a. The above-specified transmittal form is included.
   b. All other requirements specified above have been met, including, but not limited to, coordination by the CONTRACTOR, review and approval by the CONTRACTOR.
   c. The submittal contains no pages or sheets large than 11 x 17 inches.
   d. With the exception of the transmittal sheet, the entire submittal is included in a single file.
   e. Files are Portable Document Format (PDF), with the printing function enabled.
   f. All scanned manufacturers' O&M manuals must be quality checked after scanning to ensure the pages are not crooked, and all information is legible.
   g. Each electronic file shall be bookmarked.
   h. If the file exceeds 500 pages, it shall be split into two files and named Volume I and Volume II.

2. When electronic copies are provided, transmit two (2) hard copy (paper) originals to the ENGINEER, with an electronic copy on CD-ROM.

3. The electronic copy of the O&M manual shall be identical in organization, format and content to the hard copies of the manual.

4. The electronic O&M manual shall be bookmarked identically to the paper manual table of contents to allow quick access to information. Electronic submittals that require extensive scrolling will not be accepted. The document shall be indexed and searchable.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL SCHEDULE

A. O&M manuals shall be delivered directly to the OWNER or their representative, as follows:

1. Provide preliminary copies of each manual to the OWNER or their representative no later than 30 days following approval of the respective shop drawings.

2. Provide final copies of each completed manual prior to testing.

3. Provide a letter that grants the OWNER or their representative the limited right to use and reproduce each manual (in its entirety, or any portion thereof) from the respective equipment manufacturer(s). Such limited right shall allow the OWNER or their representative to use each manual or portion thereof for:
   a. The potential assembly of a comprehensive facility O&M manual for the sole benefit of the OWNER; and,
   b. supplemental training of the OWNER's personnel and operators, over and above the required vendor's training, regarding operation of the facility as a system.

B. The OWNER or their representative will review O&M manual submittals for operating equipment for conformance with the requirements of the applicable specification section. The review will generally be based on the O&M Manual Review Checklist appended to this Section.

C. If, during testing and start-up of equipment, any changes were made to the equipment, provide two hard copies of as-built drawings or any other amendments for insertion, by the CONTRACTOR, in the previously transmitted final manuals. In addition, provide one revised electronic version, including the as-built drawings and any other amendments. The manuals shall be completed, including updates, if any, within 30 days of start-up and testing of the facility.

END OF SECTION

O&M Manual Review Checklist

Submittal No.: _____
Project No.: _____
Manufacturer: _____
Equipment Submitted: _____
Specification Section: _____
Date of Submittal: _____

	General Data	
1.	Are the area representative's name, address, e-mail address and telephone number included?	
2.	Is the nameplate data for each component included?	
3.	Are all associated components related to the specific equipment included?	
4.	Is non-pertinent data crossed out or deleted?	
5.	Are drawings neatly folded and/or inserted into packets?	
6.	Are all pages properly aligned and scanned legibly?	
7.	Is the .PDF document bookmarked according to the table of contents?	
	Operations and Maintenance Data	
8.	Is an overview description of the equipment and/or process included?	
9.	Does the description include the practical theory of operation?	
10.	Does each equipment component include specific details (design characteristics, operating parameters, control descriptions, and selector switch positions and functions)?	
11.	Are alarm and shutdown conditions specific to the equipment provided on this project clearly identified? Does it describe possible causes and recommended remedies?	
12.	Are step procedures for starting, stopping, and troubleshooting specific to the equipment provided included?	
13.	Is a list of operational parameters to monitor and record specific to the equipment provided included?	
14.	Is a proposed operating log sheet specific to the equipment provided included?	
15.	Is a spare parts inventory list included for each component?	
16.	Is a lubrication schedule for each component specific to the equipment provided included - or does it clearly state “No Lubrication Required"?	
17.	Is a maintenance schedule for each component specific to the equipment provided included?	
18..	Is a copy of the warranty information included?	

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 WORK INCLUDED

A. This Section addresses Work scope to be undertaken as demolition and removal of existing infrastructure as shown in the Drawings and/or otherwise specified in the Contract Documents.

1.02 DEFINITIONS

A. Selective demolition is the removal of existing selected infrastructure from its current location at the Project site in a manner that does not destroy the items to be removed, nor alter the ability of these items to be reused elsewhere for similar purpose. Selective demolition is to be executed so as not to damage adjacent infrastructure.

B. Salvage is the transport and storage of items scheduled for demolition.

1. Salvaged items are to be removed using means and methods which do not alter the useful function of the item after removal and storage.

2. Salvaged items are to be transported by the CONTRACTOR to a storage location designated by the OWNER and/or otherwise indicated in these Contract Documents.

3. Salvaged items are to be protected by the CONTRACTOR against damage or loss
   a. During removal of the salvaged items from the Project site.
   b. During transport to the OWNER's storage location.

C. Disposal is the transport of items from the Project site not scheduled for salvage, and delivery to a waste disposal site permitted to receive the items. Alternately, at the CONTRACTOR's choosing, items scheduled for disposal may be salvaged by the CONTRACTOR for their own use. The CONTRACTOR's election to salvage items scheduled for disposal shall not require interim storage of those items at the Project site, nor placement at a location where authority for that purpose has not been granted to the CONTRACTOR.

1.03 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.04 SUBMITTALS

A. Prepare, deliver and process submittals under provisions of Section 01 30 00.

B. Complete list of all deviations from the drawings and specifications.

C. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal Work, with starting and ending dates for each activity. Include indication of items to be disposed and salvaged.

1. Submit minimum of 21 calendar days prior to initiating demolition Work scope.

2. Plan approval required prior to initiating demolition Work scope.

3. Plan must demonstrate accommodation of continued OWNER operations at the Treatment Facility.

D. Pre-demolition Photographs: Submit photo images showing existing conditions of adjoining construction relative to proposed demolition/upgrade Work, including finished surfaces that might be misconstrued as damage caused by selective demolition operations.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable codes for demolition of structure, safety of adjacent structures, dust control, lead coatings removal, service utilities, discovered hazards, and safety of personnel.

B. Do not disable or disrupt building fire or life safety systems without prior written notice from the OWNER.

C. Conform to state and federal procedures upon discovery of hazardous or contaminated materials.

1.06 ITEMS TO BE REUSED AND/OR SALVAGED

A. Items to be reused include:

1. Unit heater in Blower Building. Salvage exiting unit heater and thermostat for reuse as shown on drawings.

2. Transformer ‘T2’ in Blower Building. CONTRACTOR shall be responsible for the removal and reinstallation of transformer as shown on the Drawings.

3. Emergency light in Blower Building. CONTRACTOR shall be responsible for the removal and reinstallation of emergency light as shown on the Drawings

4. Existing branch circuits in Panel ‘P1’ Salvage all existing branch circuits. Circuits to be extended to new Panel ‘P1.

5. Discharge and Aeration Basin branch air piping. Salvage all existing piping for reuse as shown on the Drawings.

6. 8-inch valve located on discharge header air piping. Salvage 8-inch valve for reuse as shown on drawings.

1.07 PRE-DEMOLITION MEETING

A. Prior to starting any demolition Work, conduct a meeting with the OWNER. At a minimum, discuss the demolition to be performed; the sequence of activities; temporary systems/unit process

shutdown or bypass; operations and duration; items to be retained by OWNER; protection of items to be retained by OWNER; and items to be disposed and disposal location.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 REQUIREMENTS

A. Protect existing items that are to remain in the area of the Work and are not to be removed or demolished.

B. To prevent damage, carefully remove materials and equipment indicated to be salvaged, reused, or relocated. Dispose of all other materials according to approved plan.

C. Maintain Work area egress and access at all times.

D. Cease operations immediately and notify the OWNER if adjacent structures appear to be in danger.

3.02 SELECTIVE DEMOLITION

A. Demolish and remove components in an orderly and careful manner, per the approved plan.

B. Protect existing ancillary facilities and appurtenances.

C. See individual technical specifications and drawings for other requirements related to demolition and cutting, patching, and surface finishing related to the Work of this Project.

D. At penetrations of fire rated wall, partitions, ceilings, roof or floor constructions, completely seal voids with fire rated material to full thickness of the penetrated element. Maintain all fire assembly rating wall or area separation construction in accordance with applicable codes.

E. Refinish any affected surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.03 DUST CONTROL

A. Fugitive Dust Control Plan. Submit minimum of 21 calendar days prior to initiating demolition Work scope. Plan approval required prior to initiating demolition Work scope.

1. Plan must demonstrate accommodation of continued OWNER operations at the GWWTF.
2. Address the following in the plan submittal:
    a. Schedule for deployment of dust control measures and materials.
    b. Manufacturer’s product data sheets for materials proposed for use in the Work.
        1) Ventilation Fans, Filters/Filtration
        2) Dust Ductwork and Enclosures
    c. Monitoring and maintenance procedures to be deployed by the CONTRACTOR to confirm control of fugitive dust.
    d. Project closeout procedures for dust control
        1) Demolition and removal of fugitive dust control.

2) Cleaning procedures for dust removal from Project site.

3.04 CLEAN UP

A. Remove demolished materials from site as Work progresses.

B. Leave areas of Work in clean condition.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Housekeeping pads.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 SUBMITTALS

A. Prepare, deliver and process submittals under provisions of Section 01 33 00, SUBMITTAL PROCEDURES.

B. Complete list of all deviations from Drawings and Specifications.

C. Product Data: For each type of product indicated.

D. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.

3. Curing compounds.

4. Floor and slab treatments.

5. Bonding agents.

6. Adhesives.

7. Repair materials.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Field quality-control reports.

H. Work plan and placement sequencing accounting for: work of other trades, installation of structural steel systems, installation of process equipment, application of concrete coatings, installation of pipe and platform system supports; and any other work that may affect or be affected by concrete placement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Provide in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. High-density overlay, Class 1 or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. Use CRSI Class 1 plastic-protected steel wire.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II

B. Normal-Weight Aggregates: ASTM C 33 coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.

2. Retarding Admixture: ASTM C 494, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.06 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Construction Chemicals - Building Systems; Confilm.
   b. Dayton Superior Corporation; Sure Film (J-74).
   c. Meadows, W. R., Inc.; EVAPRE.
   d. Unitex; PRO-FILM.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Construction Chemicals - Building Systems; Kure 1315.
   b. Conspec by Dayton Superior; Sealcure 1315 WB.
   c. Meadows, W. R., Inc.; Vocomp-30.
   d. Symons by Dayton Superior; Cure & Seal 31 Percent E.

2.07 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Sleeves for piping through new floor infills, Basis of Design: Hilti CP 680 or CFS-CID cast in place fire stop sleeve.

2.08 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

C. Patch Grout/Mortar: Basis of Design is Sikadur 42 (grout) or SikaTop 123 PLUS (mortar).

2.09 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use admixtures in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Housekeeping Pads, Floor Infill & Plinths: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.

3. Slump Limit: 6 inches plus or minus 3/4 inch.

4. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd. increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete. Tool edges where plinths are flush with grating.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 REMOVING AND REUSING FORMS

A. General: Formwork for sides of walls and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.04 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.05 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.06 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.07 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

D. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

3.08 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.09 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Housekeeping Pads & Plinths: Cure vertical projections in the same manner as floor slabs.

F. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat

process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 LIQUID FLOOR TREATMENTS

A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

1. Prior to application, ensure that all sealing materials are compatible with final coating systems.

3.11 CONCRETE SURFACE REPAIRS

A. Existing Concrete (to remain): Where demolition of existing tanks, equipment, housekeeping pads, etc leaves the concrete to remain cracked, spalled, or otherwise damaged, repair and patch these areas. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Existing Slabs (to remain): Repair existing slabs by using a slab repair mortar to create a level, undamaged surface. Prepare existing concrete as recommended by manufacturer of repair mortar.

C. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

D. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

1. Contractor may use pre-mixed grouts or mortars as noted in Materials.

E. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

F. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

G. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

H. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.12 FIELD QUALITY CONTROL

A. Quality Assurance (QA) Inspecting and Testing: Owner will engage a qualified Special Inspection and Testing agency to perform tests and to submit reports.

1. Special Inspection is not required for typical concrete preparation or installation.

2. Testing per 3.14.C is required for all concrete.

3. Special Inspection is also required for:
   a. Post-installed anchors

B. Quality Control (QC) Inspections and Testing: Contractor shall provide third party or internal QC inspection:

1. Steel reinforcement placement.

2. Verification of use of required design mixture.

3. Concrete placement, including conveying and depositing.

4. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Compression Test Specimens: ASTM C 31.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

5. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

7. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28

days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.

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

11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.13 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments manufacturer.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Section Includes:

1. Slotted channel framing.

2. Miscellaneous steel framing.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 SUBMITTALS

A. Prepare, deliver and process submittals under provisions of Section 01 33 00, SUBMITTAL PROCEDURES.

B. Complete list of all deviations from Drawings and Specifications.

C. First four paragraphs below are defined in Division 01 Section "Submittal Procedures" as "Action Submittals."

D. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.04 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 FERROUS METALS

A. Steel Plates, Channels, and Bars: ASTM A36.

B. Piping: ASTM A53.

C. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Grade: ASTM A1011 SS GR 33

2. Size of Channels: 1-5/8 by 1-5/8 inches.

2.03 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A with hex nuts, ASTM A563; and, where indicated, flat washers.

B. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

C. Slotted Channel Fittings: ASTM A36, A1011 SS GR 33.

D. Slotted Channel Nuts & Spring Nuts: ASTM A576 GR 1015 and A1011 SS GR 45.

2.04 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780

2.05 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. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

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

1. Fabricate units from slotted channel framing where indicated.

2. Furnish inserts for units installed after concrete is placed.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

PART 3 EXECUTION

3.01 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. 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.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 FIELD QUALITY CONTROL

A. None is required.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SCOPE

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

1.02 WORK INCLUDED

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

B. Division 01 of the specifications is to be specifically included as well as all related drawings.

1.03 RELATED WORK

A. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all mechanical equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, damper motors, electric switches, electrical components, wiring and any other miscellaneous Division 23 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical drawings.

B. Carefully coordinate all work with the electrical work shown and specified elsewhere.

1.04 REFERENCED CODES - LATEST ADOPTED EDITION

A. NFPA 70 National Electrical Code (NEC).

B. IMC International Mechanical Code.

C. UPC Uniform Plumbing Code.

D. IECC International Energy Conservation Code.

E. IFC International Fire Code.

F. IFGC International Fuel Gas Code.

G. IBC International Building Code.

1.05 PROJECT RECORD DRAWINGS

A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will

become permanently concealed. Show routing of work in concealed blind spaces within the building. Show exact dimensions of buried piping off of columns or exterior walls.

B. Maintain record documents at job site in a clean, dry and legible condition. Keep record documents available for inspection by the Project Manager.

C. Show the location of all valves and their appropriate tag identification.

D. At completion of project, deliver these drawings to the Project Manager and obtain a written receipt.

1.06 SUBMITTALS

A. See Section 01 30 00 for submittal procedures.

B. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories in order of the Specification Sections. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications.

C. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.

D. Only submit on items specifically required by each specification section. If a submittal has not been requested, it will not be reviewed.

E. Submit product data for:

1. Hangers and Supports for HVAC Piping and Equipment.

2. Identification for HVAC Piping, Ductwork and Equipment.

1.07 OPERATING AND MAINTENANCE MANUALS

A. See Section 01 78 36 for Operation and Maintenance Data requirements.

1.08 HANDLING

A. See Section 01 60 00 for delivery, storage, and handling.

1.09 DIMENSIONS

A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.

B. Any differences, which may be found, shall be submitted to the Project Manager for consideration before proceeding with the work.

1.10 MANUFACTURER'S DIRECTIONS

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

1.11 COOPERATION AND CLEANING UP

A. The Contractor for the work under each section of the specifications shall coordinate the Contractors work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on the work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

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

1.12 WARRANTY

A. Unless a longer warranty is hereinafter called for, all work, materials and equipment items shall be warrantied for a period of two (2) years after final acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Engineer, shall be repaired and/or replaced to the complete satisfaction of the Engineer.

1.13 COMPLETION REQUIREMENTS

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

1. Accurate project “As-Built” drawing, shown in red ink, showing all changes from conformed set of drawings made during installation of the work.

2. Contractors Two (2) Year Warranty.

3. All Manufacturers’ Guarantees.

4. Operation and Maintenance Manuals.

1.14 INSPECTION OF SITE - REMODEL PROJECTS

A. The accompanying drawings do not indicate completely the existing plumbing and mechanical installations. The Contractor shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

1.15 RELOCATION OF EXISTING INSTALLATIONS

A. There are portions of the existing mechanical systems, which shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, the Contractor shall determine those portions of the remaining present installations, which must be relocated to avoid interference with the installations of new work of the Contractors particular trade and that of all other trades. All such existing installations, which interfere with new installations, shall be relocated by the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.

B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

2.02 RESTRICTED MATERIALS

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

B. Where materials or equipment provided by this Contractor are found to contain restricted materials, such items shall be removed and replaced with non-restricted materials items. Entire cost of restricted materials removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those restricted materials containing items installed by the Contractor.

2.03 ELECTRICAL MOTORS

A. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than + 10% of rated voltage. Motors for pumps and fans shall be selected to be non-overloading.

B. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.

C. All motors for use with equipment with variable frequency drives shall be inverter ready motors. Verify compatibility and sizing of motor with variable frequency drive.

D. Size motors for 1.15 service factor and not to exceed 40º C temperature rise above ambient.

E. Fractional horsepower motors to have self-resetting thermal overload switch.

F. Provide Premium Efficiency, motors for all three phase motors one horsepower and larger. Standard efficiency motors will not be acceptable.

2.04 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

A. Plastic Nameplates: Laminated plastic with engraved letters.

B. Plastic Tags: Laminated plastic with engraved letters, minimum 1-1/2 inches diameter.

2.05 HANGER RODS

A. Steel Hanger Rods: Threaded both ends, or continuous threaded. Finish shall be hot dipped galvanized.

2.06 FLASHING

A. Metal Flashing: 26-gauge minimum epoxy coated steel. Finish shall match building exterior.

B. Metal Counter Flashing: 22 gauge minimum galvanized steel.

2.07 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. B-Line Systems.

3. Unistrut Corp.

B. Product Description: Channel members shall be 1-5/8” x 1-5/8” and fabricated from 12-gauge steel. Finish shall be hot dipped galvanized. The hole pattern on the back of the channel shall be either unpierced, “HS or “T”.

PART 3 EXECUTION

3.01 DRAWINGS

A. The drawings are partly diagrammatic, not necessarily showing all offsets or exact locations of piping and ducts, unless specifically dimensioned. The contractor shall provide all materials and labor necessary for a complete and operable system. Complete details of the building which affect the mechanical installation may not be shown. For additional details, see Architectural, Process, and Electrical Drawings. Coordinate work under this section with that of all related trades.

3.02 INSTALLATION

A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the IMC, UPC, IBC, NEC, NFPA, IECC, IFGC and IFC Standards; all local and state amendments to all codes and standards.

B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.

C. Compliance with codes and ordinances shall be at the Contractor's expense.

D. Install in accordance with manufacturer's instructions.

3.03 MEASUREMENTS

A. Verify all measurements on the job site.

B. Locate all equipment on the centers of walls, openings, spaces, etc., unless specified otherwise.

3.04 CUTTING, FITTING, REPAIRING, PATCHING AND FINISHING

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

3.05 IDENTIFICATION

A. Label all equipment with heat resistant laminated plastic labels having engraved lettering ½" high. If items are not specifically listed on the schedules, consult the Engineer concerning designation to use. Seton engraved Seton-Ply nameplates or equal.

3.06 FLASHING

A. Provide flexible flashing and metal counter-flashing where ductwork penetrate weather or waterproofed walls.

3.07 INSTALLATION OF EQUIPMENT

A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.

B. Maintain manufacture recommended minimum clearances for access and maintenance.

C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.

D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, ductwork, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Duct Materials.

2. Ductwork Fabrication.

1.02 REFERENCES

A. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

B. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.03 SUBMITTALS

A. See Section 01 30 00 for submittal procedures.

B. Product Data: Submit data for duct materials.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible. Maintain one copy of each document on site.

1.05 QUALIFICATIONS

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

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

1.06 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.

PART 2 PRODUCTS

2.01 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M.

B. Steel Ducts: ASTM A568/A568M.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36/A36M; steel, hot dipped galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 LOW PRESSURE DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Use double nuts and lock washers on threaded rod supports.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Install duct hangers and supports in accordance with Section 23 05 00.

C. Use double nuts and lock washers on threaded rod supports.

3.02 SCHEDULES

A. Ductwork Material Schedule:

Air System	Material
General Exhaust	Steel

END OF SECTION

SECTION 23 34 00
HVAC FANS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

A. Axial flow fans.

1.02 REFERENCES

A. Underwriters Laboratories Inc.:

A. UL 705 - Power Ventilators.

1.03 SUBMITTALS

A. Product Data: Submit data on 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.

1.04 QUALIFICATIONS

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

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.06 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.07 WARRANTY

A. Unless a longer warranty is hereinafter called for, all work, materials and equipment items shall be warrantied for a period of two (2) years after final acceptance by the Owner.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Dayton, or approved equal

2.02 AXIAL/MIXED FLOW FANS

A. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.

A. Axial flow fan constructed of aluminum. Integral screen on inlet, and shutter/backdraft damper on outlet.

B. Fan shall be equipped with motor mounted speed controller.

C. Motor: Open drip proof.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate with other trades for installation of wall penetrations.

3.02 INSTALLATION

A. Install safety screen on duct inlet as indicated on plans.

3.03 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

END OF SECTION

SECTION 26 01 26
ELECTRICAL TESTS

PART 1 GENERAL

1.01 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 apply to the Work of this Section.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 SUBMITTALS

A. Test Procedure Submittals

1. The CONTRACTOR shall submit the proposed procedures to be followed during testing of the electrical tests required herein.

2. Preliminary Submittal: CONTRACTOR to outline the specific proposed tests and examples of proposed forms and checklists.

B. Field Test Results Submittals

1. CONTRACTOR shall submit test results immediately upon completion of testing for review and approval by OWNER or OWNER'S representative prior to energization of new Work.

1.04 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. Cable Testing: 480VAC circuits, 208VAC circuits and 120VAC circuits shall be tested for insulation resistance with a 1000-volt megohm meter. Testing shall be done before the equipment is terminated. Control and signal wires shall be tested for continuity and resistance to ground.

3. Test all recircuited and new Ground Fault Interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.

4. 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 CONTRACTOR or 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.

B. Subsystem 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. Provide ground resistance tests on the main grounding bars in all lighting panels, transformers and control panels in the presence of the ENGINEER and submit results.

E. Subsystems shall be defined as individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, etc.

F. General: Perform tests indicated herein for individual items of materials and equipment in other Sections.

G. 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

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide electrical Work, complete and operable, in accordance with the Contract Documents.

B. 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.

C. 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.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 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
NETA	International Electrical Testing Association
NEMA 250	Enclosure for Electrical Equipment (1000 Volts Maximum)
	Anchorage Electrical Code amendments to the NEC

B. Electrical equipment shall be listed by, and shall bear the label of, Underwriters' Laboratories, Inc. (UL).

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.

1.04 SIGNAGE

A. Local Disconnect Switches:

1. Each local disconnect switch for motors and equipment shall be permanent legibly marked with engraved nameplate attached with SST fasteners to indicate its purpose.

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, per NFPA 70E.

C. All electrical equipment and panelboards operating at voltages over 50V shall be provided with a label clearly identifying the voltage present, per NEC.

D. The method used to identify the conductors of each voltage system within the premises shall be permanently labeled on each of the originating switchboards or panelboards, per the NEC.

E. Isolating Switches: Isolating switches not interlocked with an approved circuit interrupting device shall be provided with a sign warning against opening them under load.

F. Arc Flash Warning Labels

1. Perform Arc Flash Hazard calculations on the specific electrical distribution equipment being provided, including all overcurrent protective devices. Calculations shall be performed in accordance with IEEE Standard 1584, and the results, including short circuit and incident energy values at each piece of equipment, shall be submitted to the ENGINEER for approval.

2. Provide arc flash warning labels with incident energy level values and personnel protective equipment (PPE) requirements on each piece of equipment, in accordance with NEC article 110.16 and NFPA 70E.

G. Provide a warning label on all equipment that can be remotely or automatically started, stating "Warning: Equipment May Start at Any Time".

1.05 PROTECTIVE DEVICE STUDIES

A. CONTRACTOR shall provide short-circuit, arc flash and protective device coordination studies. These studies shall be performed by Rockwell. The studies shall be prepared for the electrical overcurrent devices to be installed under this Project. Provide labels for all new equipment, including, but not limited to, individual protective devices, Motor Control Centers (MCCs), equipment disconnects, and panels, based on the results of the studies. Previous studies, including the most recent, have been performed by Rockwell.

B. Submittals

1. The indicated studies shall be submitted and approved by the ENGINEER prior to final approval of the distribution equipment Shop Drawings and release of equipment for manufacture.

2. An initial short circuit study shall be submitted and reviewed before the ENGINEER will approve the Shop Drawings for 480-volt MCC, transformers, 208-volt panel boards and associated equipment.

3. Submit an initial protective device coordination study within 30 days after the approval of the initial short circuit study.

4. The short circuit, arc-flash hazard analysis, and protective device coordination studies shall be updated prior to Project Substantial Completion and prior to installation of labels; utilize characteristics of as-installed equipment and materials.

5. The documentation shall be provided to the ENGINEER showing adequacy of the equipment "withstand" and interruption ratings.

C. Study Requirements

1. The study shall include all typical operating arrangements of the AC power electrical system, including all combinations of the CEA Services and Standby Generator supplying power.

2. The study shall include one-line diagram, short-circuit study, protective devices evaluation study, protective devices coordination study, and protective coordination plots for all overcurrent protective devices.

3. One Line Diagram:
   a. Show all electrical equipment and wiring to be protected by the overcurrent devices, including, but not limited to:
      1) Power devices
      2) Transformers
      3) Circuit breakers
      4) Relays
      5) Fuses
      6) Busses
      7) Cables
   b. Show the following specific information:
      1) Calculated fault impedance, X/R ratios, and short-circuit values at each feeder and branch circuit bus.
      2) Relay, circuit breaker, and fuse ratings.
      3) Generator kW/kVA and transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
      4) Voltage at each bus.
      5) Identification of each bus, matching the identification on the drawings.
      6) Conduit, conductor, and busway material, size, length, and X/R ratios.

4. Short-Circuit Study:
   a. The study shall be performed using computer software designed for this purpose. Pertinent data and the rationale employed in developing the calculations shall be described in the introductory remarks of the study.
   b. Calculate the fault impedance to determine the available short-circuit and ground fault currents at each bus. Incorporate applicable motor and/or generator contribution in determining the momentary and interrupting ratings of the overcurrent protective devices.

c. Present the results of the short-circuit study in a table. Include the following:
   1) Device identification.
   2) Operating voltage.
   3) Overcurrent protective device type and rating.
   4) Calculated short-circuit current.

5. Protective Device Evaluation study:
   a. A protective device evaluation study shall be performed in order to determine the adequacy of circuit breakers, molded case switches, and fuses.
   b. Any problem areas or inadequacies in the equipment due to prospective short-circuit currents shall be promptly brought to the attention of the ENGINEER.
   c. Do not utilize series-rated circuit breakers to meet short circuit requirements for this Project.
   d. Devices shall be fully rated to withstand available fault currents.

6. Protective Device Coordination Study:
   a. A protective device coordination study shall be performed in order to develop the necessary calculations to select power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low-voltage breaker trip characteristics and settings.
   b. Any problem areas or inadequacies in the equipment due to prospective short-circuit currents shall be promptly brought to the ENGINEER's attention.
   c. The study shall be inclusive of all distribution feeders and recommendations implemented.

7. Coordination Curves:
   a. Prepare the coordination curves to determine the required settings of overcurrent protective devices to demonstrate selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between devices, including the utility company upstream device, if applicable. Plot the specific time-current characteristics of each overcurrent protective device in such a manner that all devices are clearly depicted.
   b. The following specific information shall also be shown on the coordination curves:
      1) Device identification.
      2) Potential transformer and current transformer ratios.
      3) Three-phase and single-phase ANSI damage points or curves for each cable, transformer, or generator.
      4) Applicable circuit breaker or protective relay characteristic curves.
      5) No-damage, melting, and clearing curves for fuses.
      6) Transformer in-rush points.
   c. Develop a table to summarize the settings selected for the overcurrent protective devices. Include the following in the table:
      1) Device identification.
      2) Protective relay or circuit breaker potential and current transformer ratios, sensor rating, and available and suggested pickup and delay settings for each available trip characteristic.
      3) Fuse rating and type.

8. Arc Flash Study:
   a. An arc flash study shall be performed with the aid of a digital computer program in order to determine the “Arc Flash Protection Boundary” and “Personal Protective

Equipment" (PPE) levels for applicable electrical distribution equipment, stand-alone disconnects, and starters in the power distribution system.

b. The arc flash study shall be performed in conjunction with short circuit calculations and protective device coordination.

c. The arc flash study shall be in accordance with the latest version of the following standards:

NFPA 70E	Standard for Electrical Safety Requirements for Employee Workplaces
IEEE 1584	IEEE guide for performing Arc Flash Hazard Calculations
OSHA (29 CFR PART 1910)	Occupational Safety and Health Standards for General Industry
ANSI Z535.4	Product Safety Signs and Labels

d. The recommended values for the "Arc Flash Protection Boundary" and PPE levels, based on the arc flash study results, shall be tabulated in the study.

e. The arc flash analysis shall include calculations for maximum and minimum contributions of the fault current magnitude. The minimum calculation shallassume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

f. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

g. Arc flash calculations shall be performed for each generator supplying power and utility supplying power.

h. Safety and Arc Flash Placards

1) The digital computer program shall provide the "Arc Flash Protection Boundary" and PPE values in a format that can be directly printed on to labels for the worst case result.

2) OSHA compliant labeling shall be included on all electrical panels, equipment, and applicable raceways. This includes:

a) high voltage warning
b) arc flash hazard rating
c) system voltage
d) maximum fault current
e) series combination rating
f) amps interrupting rating (AIC)
g) clearance requirement warning
h) turn off power prior to working inside equipment
i) label for conductor color coding
j) label to identify power source
k) other OSHA/NEC required labelling depending on installation

3) The CONTRACTOR shall provide (furnish and post in the field) these labels.

4) The CONTRACTOR shall merge the arc flash results and provide a complete list for a worst case value for each bus.

D. Analysis and Final Report

1. Provide final report with all findings, diagrams, graphs, data, and recommendations.

2. Analyze the short-circuit calculations, and highlight any equipment determined to be underrated as specified. Propose solutions to effectively protect the underrated equipment.

E. Adjustments, Settings, And Modifications

1. Final field settings and minor modifications of the overcurrent protective devices shall be made by a qualified field engineer to conform with the study, without additional cost to the OWNER.

1.06 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.

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.

1.07 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.

1.08 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with MASS Section 10.05 Article 5.6.

B. Shop Drawings: Include the following:

1. Complete material lists stating manufacturer and brand name of each item or class of material.

2. Shop Drawings for all grounding Work not specifically indicated.

3. Front, side, rear elevations, and top views with dimensional data.

4. Location of conduit entrances and access plates.

5. Component data.

6. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers.

7. Method of anchoring, seismic requirements, weight.

8. Types of materials and finish.

9. Nameplates.

10. Temperature limitations, as applicable.

11. Voltage requirement, phase, and current, as applicable.

12. Front and rear access requirements.

13. Test reports.

14. Grounding requirements.

15. Catalog cuts of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material. Catalog data sheets 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.

1.09 AREA DESIGNATIONS

A. General:

1. Raceway system enclosures shall comply with Section 26 05 33.

2. Electrical Work specifically indicated in Sections within any of the specifications shall comply with those requirements.

3. Electrical Work in above ground indoor facilities shall be NEMA 1.

4. Electrical Work in below ground facilities and outdoors shall be NEMA 3R.

5. Installations in hazardous locations shall conform strictly to the requirements of the Class, Group, and Division indicated.

B. Material Requirements:

1. NEMA 3R enclosures shall be rainproof, steel, coated with ANSI 61, powder painted epoxy, color:grey.

2. NEMA 1 enclosures shall be steel, coated with ANSI 61, powder painted epoxy, color:grey.

1.10 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 immediately upon completion of test for review and approval by OWNER or OWNER's representative prior to energization of new Work. .

C. Equipment or material which fails a test shall be removed and replaced.

1.11 DEMOLITION AND RELATED WORK

A. The CONTRACTOR shall perform electrical demolition Work as indicated on the electrical drawings and in parts of this 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 that were abandoned in this Project.

3. Encased conduits shall be cut 0.75-inch below flush to the floor, wall and ceiling surfaces and be grouted level to the surface.

4. Remove remote mounted starters, disconnect switches, circuit breakers, sensors, and transmitters.

5. Remove remote mounted status lights and switches where indicated on the electrical drawings, and blank off openings in existing panels with field-fabricated 316 stainless steel plates. Plates shall be attached with 316 stainless steel finish screws.

C. Where new lighting and receptacles are installed, old lighting, receptacles, switches, wiring, and conduits shall be removed.

D. Raceways to be reused or extended shall be terminated in a new junction box. The junction box shall have a NEMA rating in accordance with the area in which it is located and shall be sized as required.

E. 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.

F. Material and equipment indicated to be relocated or reused shall be removed and relocated, and reinstalled with care to prevent damage thereto.

G. 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.

H. 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 re-printed to indicate the revised circuits. Pencil or magic marker markings directly on the panel schedules, MCC or panelboard breaker are not permitted.

1.12 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, to minimize required process or equipment shutdown time. The CONTRACTOR shall submit a written request including sequence and duration of activities to be performed during plant shutdown.

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 AWWU plant supervisor and the ENGINEER. The CONTRACTOR shall remove the lock within 4 hours upon request of AWWU, in an emergency, and if the equipment is operable.

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 substation switchboards to integrate new power circuit breakers. Costs for this Work shall be included in the CONTRACTOR's original Bid amount.

E. The CONTRACTOR is advised to visit the site before submitting a Bid to better acquaint itself 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 MCC equipment, distribution panel circuit breakers, branch panel circuit breakers, motor starters, control panels, equipment, devices, luminaires, wireways, cables, and instruments in accordance with the agreed upon 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 that is new or is out of service.

2. Minimum down time Requirements: The CONTRACTOR shall minimize the amount of time a facility is out of service. The CONTRACTOR shall provide the ENGINEER with an estimate of the amount of time a facility will be out of service.

3. The ENGINEER will coordinate with the CONTRACTOR to load and commission the PLC software after the CONTRACTOR makes the wiring modifications.

4. 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 Substantial Completion, and shall extend for 2 years, in accordance with MASS Division 10.

PART 2 PRODUCTS

2.01 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.

2.02 MOUNTING HARDWARE

A. Miscellaneous Hardware:

1. Nuts, bolts, and washers shall be hot dipped galvanized steel.

2. Threaded rods for trapeze supports shall be continuous-threaded, hot dipped galvanized steel, 3/8-inch diameter minimum.

3. Strut for mounting of raceways and equipment shall be hot dipped galvanized, 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.

4. Anchors for attaching equipment to concrete walls, floors and ceilings shall be carbon steel with hot dip galvanized (HDG) finsihl 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.

2.03 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 316 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. All field wires shall be labeled at each termination point.

PART 3 EXECUTION

3.01 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, 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, or "home runs," are shown, the CONTRACTOR shall route the raceways in accordance with the indicated installation requirements. Routings shall be exposed.

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 CONTRACTOR shall de-rate conductor ampacities in accordance with NEC requirements.

4. Where complete raceway systems are not shown on the drawings, Contractor shall submit a raceway plan for approval. Intent is to minimize number of raceway systems.

C. MOA NEC Local Amendments: The CONTRACTOR shall comply with all requirements of the MOA 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.

G. The CONTRACTOR shall provide modifications to existing MCCs in accordance with Section 26 24 19 – Low Voltage Motor Control Center, for starters in MCCs.

3.02 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.

3.03 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, 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 inches above finished floor or grade.

3.04 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 under MASS Section 10.05 Article 5.6.

C. Panels, raceways, and other equipment shall be anchored and supported for seismic requirements of MOA Building Safety.

3.05 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.

3.06 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.

3.07 CONTROL PANEL WIRING

A. The CONTRACTOR shall ensure all panels are UL listed upon completion of the Work.

END OF SECTION

SECTION 26 05 19
WIRE AND CABLES

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide wires and cable, complete and operable, in accordance with the Contract Documents.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit Shop Drawings in accordance with Section 01 30 00, and Section 26 05 00.

PART 2 PRODUCTS

2.01 GENERAL

A. Conductors, including grounding conductors, shall be copper. Aluminum conductor wire and cable shall 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 NEC, latest 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.

2.02 LOW VOLTAGE WIRE AND CABLE

A. Power and Lighting Wire

1. Power and lighting wire shall be No. 12 copper AWG minimum size.

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.

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-inch.

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.

6. No. 16 AWG, 7 conductor, stranded tinned copper with PVC jacket cable shall be Belden Part No. 8621, or equal.

D. Tray Cable - Tray cable is not to be used.

E. Cat 6 Cable: Cat 6 patch cable shall be 4-pair 24-gauge twisted pair rated to TIA/EIA 568-B Cat. SE and UL listed. The CONTRACTOR shall install RJ-45 connectors as required.

F. DeviceNet Cable: Shall be 600-volt rated sunlight resistant, 65 percent braid coverage, UL Listed, Allen-Bradley DeviceNet Thick Trunk Cable, Type TC, or 300-volt Thin Cable, as shown on the drawings.

2.03 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.

PART 3 EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall provide and terminate all power, control, and instrumentation conductors, except where indicated.

3.02 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. Use water-based lubricant. Wax-based not permitted.

E. The following wiring shall be run in separate raceways, unless otherwise noted:

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.

3.03 SPLICES AND TERMINATIONS

A. General

1. Wire taps and splices shall not 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 pullboxes.

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. 120/208-volt AC, 120/240-volt AC, and 480/277-volt AC circuit conductors shall not 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.

3.04 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. Use existing identification number where new equipment is installed to replace existing. 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:
   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, but 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, mylar, self-sticking labels attached under the terminal strip.

3.05 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 01 30 00 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 megohmeter.

2. Field testing shall be performed 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 26
GROUNDING

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide the electrical grounding system, 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.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 30 00, and Section 26 05 00.

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

2.01 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.

2.02 GROUNDING SYSTEM

A. 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.

B. 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.

C. Manufacturers of grounding materials shall be Copperweld, Blackburn, Burndy, or equal.

PART 3 EXECUTION

3.01 GROUNDING

A. Provide a separate 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 full size grounding conductor in each individual raceway for parallel feeders per the NEC.

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, exposed metal systems, and metallic building structure per NEC. Bond ALL water pipe penetrations.

K. 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 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes the requirements for devices used for the support of electrical conduit and equipment.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 SUBMITTALS

A. In accordance with the requirements of Section 01 30 00, submit the following Project data:

1. Descriptive literature bulletins, and catalog cuts of the equipment.

2. Materials of construction.

3. Complete installation instructions, with points of electrical connection requirements clearly shown.

4. Load calculation showing adequate strength for present load plus provision for future load addition. Contractor shall submit with conduit shop drawings.

PART 2 PRODUCTS

2.01 MATERIAL

A. Support raceways and enclosures on approved types of wall brackets, ceiling trapeze hangers, or malleable iron straps.

1. “Kindorf", "Unistrut", or equal.

2. Plumbers perforated strap not permitted as means of support.

3. Carbon steel with hot dip galvanized (HDG) finish supports and hardware in all locations.

4. Provide end caps on all exposed corners and edges of supports and fittings.

B. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.

1. Channel Thickness: Selected to suit structural loading.

2. Fittings and Accessories: Products of the same manufacturer and material as channel supports.

C. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers and wall brackets.

D. Expansion Anchors: Carbon steel with hot dip galvanized (HDG) finish

E. Toggle Bolts: Carbon steel with hot dip galvanized (HDG) finish

F. Powder-Driven Threaded Studs: Carbon steel with hot dip galvanized (HDG) finish

G. Earthquake Anchorages.

1. Anchor equipment weighing more than 100 pounds to the building structure to resist lateral earthquake forces.

2. Total lateral (earthquake) force shall be 1.00 times the equipment weight acting laterally in any direction through the equipment center of gravity. Provide adequate backing at structural attachment points to accept the forces involved.

3. Provide equipment supported by flexible isolation mounts with earthquake restraining supports positioned as close to equipment as possible without contact in normal operation (earthquake bumpers). The maximum lateral displacement due to the computed earthquake force from above shall not exceed 1.5 inches. Floor mounted equipment weighing less than 2000 pounds may have one 6 x 6 x 3/8 x 18-inch steel angle bolted to the floor with four 5/8-inch diameter bolts placed on each of four sides of the equipment.

H. All unistrut and mounting hardware shall be carbon steel with hot dip galvanized (HDG) finish; all hardware used to mount or hang unistrut shall match the selected product.

PART 3 EXECUTION

3.01 INSTALLATION

A. Pipe straps and hanger rods shall be fastened to concrete by means of inserts, expansion bolts, or powder-driven fasteners, and to hollow masonry by means of toggle bolts. Powder-driven fasteners may only be used where pre-approved.

B. Secure boxes, wall brackets, cabinets, and hangers by means of toggle bolts in gypboard and masonry CMU and wood screws in wood construction. Obtain permission before using any type of powder-powered studs.

C. Support luminaires from structural members capable of supporting total weight, and independently from wiring system. Attach to gypsum board by approved toggle bolts (minimum of one bolt for each 2 square feet of fixture or fraction thereof).

END OF SECTION

SECTION 26 05 33
ELECTRICAL RACEWAY SYSTEMS

PART 1 GENERAL

1.01 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 the circuit conductors shall be:
   a. A copper 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.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 DEFINITIONS

A. Raceway System – raceway system consists of conduits, wireways, fittings, junction and pull boxes, supports, labels complete and ready for conductors.

PART 2 PRODUCTS

2.01 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.

2.02 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.

B. 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".

C. Electrical Metallic Tubing (EMT) or Intermediate conduit (IMC) shall not be accepted.

2.03 FITTINGS AND BOXES

A. General:

1. Cast and malleable iron fittings for use with metallic conduit shall be the threaded type with five full threads.

2. In outdoor areas, raceways shall be terminated in raintight hubs as manufactured by Myers, O.Z. Gedney, or equal.

B. Malleable Iron Fittings and Boxes

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.

2.04 WIREWAYS

A. Wireways shall not be used.

2.05 CABLE TRAYS

A. Cable trays shall not to be used.

PART 3 EXECUTION

3.01 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 inches. Factory elbows may be utilized on raceways over 2 inches. 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 voltage wiring

D. 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 1/2-inch LFMC to a splitter box where the wiring shall 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.

E. Where raceway routings are indicated on plan views, follow those routings to the extent possible. See Section 26 05 00, Paragraph 3.01, B for additional installation requirements.

F. 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.

G. Support rod attachment for ceiling-hung trapeze installations shall meet the seismic requirements.

H. Exposed raceways shall be installed parallel or perpendicular to structural beams.

I. Install expansion fittings with bonding jumpers wherever raceways cross building expansion joints.

J. 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.

K. In NEMA 4X areas, all raceway penetrations in panels shall be bottom entry.

L. Wherever contact with concrete or dissimilar metals can produce galvanic corrosion of equipment, suitable insulating means shall be provided to prevent such corrosion.

M. 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.

N. 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 TWSH
3/4”	8	2
1”	16	4
1-1/4”	32	7
1-1/2”	48	10
2”	72	17

O. Note: No instrumentation or control wiring conduit shall be larger than 2 inches in diameter.

3.02 RACEWAYS

A. Exposed raceway systems shall be as follows, unless indicated otherwise:

1. In all outdoor areas and indoor areas GRC shall be utilized.

B. Raceways concealed, buried, or encased in concrete, shall be GRC. Where conduit emerges from concrete encasement, a RGS elbow shall be utilized for 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.

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 shall 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.

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.

3.03 CABLE TRAYS

A. Cable trays shall not to be used.

END OF SECTION

SECTION 26 24 16.05
PANELBOARDS

PART 1 GENERAL

1.01 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.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 CONTRACTOR SUBMITTALS

A. General: Submittals shall be in accordance with MASS Section 10.05 Article 5.6 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

2.01 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 120/208-volt, 3-phase operation or 120/240-volt for single phase operation as indicated. Power panelboards shall be rated for 480 volts, 3-phase, 3-wire operation.

B. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.

C. Ratings

1. Panelboards rated 240 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.

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, or Eaton.

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 NEC.

PART 3 EXECUTION

3.01 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 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 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 and the following specifications

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 SUBMITTALS

A. In accordance with the requirements of Section 01 30 00, 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.

1.04 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. All equipment shall conform to appropriate provision of NEMA. IEC Rated, or Dual NEMA/IEC-Rated equipment shall not be allowed, even though UL Listed.

PART 2 PRODUCTS

2.01 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. 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.

C. 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.

D. 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.

PART 3 EXECUTION

3.01 INSTALLATION

A. Size devices as required by the load being served or as shown on the drawings.

END OF SECTION

SECTION 40 05 01
PROCESS PIPING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnish, install, and test process piping systems and appurtenant items as specified herein, in coordination with related specification Sections, and as shown on the Drawings.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

B. See Specification Section 43 11 21 HIGH EFFICIENCY TURBO BLOWERS for valves and piping appurtenances provided with the Blower Manufacturer's equipment package.

1.03 QUALITY ASSURANCE/REFERENCES

A. As applicable, meet the requirements of the most recent version of the following standards, regulations, and requirements as may be referenced in this Section and the Contract Documents.

1. American Society for Testing and Materials (ASTM)
   a. A47 Standard Specification for Ferritic Malleable Iron Castings
   b. A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   c. A105 Standard Specification for Carbon Steel Forgings for Piping Applications
   d. A106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
   e. A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   f. A194 Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
   g. A320 Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
   h. A536 Standard Specification for Ductile Iron Castings
   i. A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   j. D6386. Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

2. American National Standards Institute (ANSI); American Society of Mechanical Engineers (ASME). Nominal Pipe Size (NPS).
   a. B1.20.1 Pipe Threads, General Purpose, Inch
   b. B16.3 Malleable Iron Threaded Fittings Classes 150 and 300
   c. B16.5 Pipe Flanges and Flanged Fittings: NPS ½-inch through 24-inch
   d. B31.3 Process Piping

3. ANSI/American Water Works Association (AWWA):
   a. C606 Grooved and Shouldered Joints

4. AWWA Manual M11 Steel Water Pipe – A Guide for Design and Installation

5. International Building Code. Seismic loading and bracing.
   a. Design, size, and locate valve and operator support systems as required, whether or not indicated in Drawings.
   b. Support Load: Dead loads imposed by weight of valve filled with water and operator. Safety Factor: Minimum of 5.

6. Alaska Department of Environmental Conservation (ADEC), Alaska Administrative Code (AAC)

7. Uniform Plumbing Code (UPC) as amended and adopted by the State of Alaska

8. Society for Protective Coatings (SSPC) Standards.

1.04 SUBMITTALS

A. Prepare, deliver, and process under provisions of Section 01 30. Requests for proposed substitute or “or-equal” equipment/systems/products will be considered in accordance with the provisions of Section 01 25 00.

B. Complete list of all deviations from the Drawings and Specifications.

C. Shop Drawings: Provide the following:

1. Materials cut sheets, product data sheets, and specifications.

2. Where new flanges and flanged equipment are to be installed:
   a. Flange standard of construction, classification, pressure class, dimensions and type, bolt circle diameter and number of bolts, and flange gasket.

3. Field Installation Drawings
   a. Details, location, dimensions, and designation by number of each pipe spool piece and fabrication.

D. Quality Control. Provide the following:

1. Pipe and Fittings: confirm Manufacturer's compliance with specified standards.

2. Leak testing plan and methods. Certifications of Calibration of testing equipment.

3. Project site functional test and results of performance confirmation checks per specification Section 01 46 50.

1.05 DELIVERY, STORAGE AND HANDLING

A. See specification Section 01 60 00. Specific process piping requirements are included below.

B. Store indoors in dry, clean area and as coordinated with OWNER or the Owner’s Representatives.

C. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.

D. Gaskets: Store gaskets in cool, dry, well-ventilated area with no exposure to direct sunlight. Do not allow gasket contact with petroleum products (oil, fuel, and solvents).

E. Threaded, Plain, or Socket Ends: Fit with metal, wood, or plastic plugs or caps.

F. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 PRODUCTS

2.01 GENERAL

A. Seismic Restraint, Load and Design: CONTRACTOR to provide support and seismic restraint design. Refer to Structural Drawings for seismic design criteria and additional requirements.

B. Piping and appurtenances, and backflow prevention air gaps and devices shall be installed in piping and equipment systems where required, as shown on the Drawings, and/or as required by the Alaska Department of Environmental Conservation, per the applicable requirements of the Uniform Plumbing Code (UPC) as amended and adopted by the State of Alaska.

C. The Contract Documents indicate specific required features of the equipment supply and systems, but do not purport to cover all details of design and construction.

2.02 PIPING

A. Design, size, and locate piping support systems, including seismic loading and bracing, whether or not indicated in Drawings. See specification Section 40 05 07 and Structural Drawings for requirements.

B. See **PIPING SCHEDULE** included at the end of this specification.

C. Piping and appurtenances specified herein per referenced standards shall meet the requirements of the most recent version of said standards.

D. GALVANIZED STEEL PIPE (GSP)

1. Service: Low Pressure Air (LPA).

2. Pipe:
   a. ASTM A106, Grade B; or ASTM A53, Grade B seamless. Schedule 10. Hot dipped galvanized (zinc coated) per pipe standard specification, and conforming to ASTM A123.
   b. Rolled groove ends suitable for couplings, fittings, and joints.

3. Couplings:
   a. For rolled groove pipe ends:
      1) Housing: Ductile iron, ASTM A536 65-45-12.
      2) Housing Coating: Enamel
      3) Gasket: Grade EHP EPDM.
      4) Bolts and Nuts: Stainless steel oval neck track bolts, ASTM F593, Group 2 (316 Stainless Steel), condition CW. Stainless steel heavy nuts, ASTM F594, Group 2 (316 stainless steel), condition CW, with galling reducing coating.
      5) Manufacturer and Model. Victaulic Company. Coupling Style 107V; Rigid (rolled groove). Or approved equal.

4. Fittings:
   a. Grooved ends.
      1) Ductile iron, ASTM A536 65-45-12.
      2) Coating: Enamel
      3) Working Pressure, Maximum: 400 psi
         a) Manufacturer and Model. Victaulic Company. Grooved End Fittings. Or approved equal.

5. Joints:
   a. Flanges:
      1) Galvanized forged carbon steel, ASTM A105, ANSI B16.5 Class 150, flat face.
         a) Bolts, Nuts and Washers: Bolts and nuts for flanges shall be 316 stainless steel conforming to ASTM A320, Grade B8M, for bolts; and ASTM A194, Grade 8M, for nuts. Washers shall be the same material as the bolts.
         b) Gasket: Full face, ⅛-inch thick EPDM.
      2) Rolled groove end adapter flange:
         a) Housing: Ductile iron, ASTM A536 65-45-12.
         b) Housing Coating: Enamel
         c) Gasket: Grade EHP EPDM.
         d) Bolts and Nuts: Stainless steel oval neck track bolts, ASTM F593, Group 2 (316 Stainless Steel), condition CW. Stainless steel heavy nuts, ASTM F594, Group 2 (316 stainless steel), condition CW, with galling reducing coating.
         e) Manufacturer and Model. Victaulic Company. Style 741. Or approved equal.

6. Service Saddle
   a. Tap from GSP LPA pipe to ¾-inch SST LPA pipe.
   b. Materials of Construction: Stainless steel shell, bolts, nuts, washers, and tapped outlet.
   c. Gasket: NBR per ASTM D2000.
   d. Manufacturer and Model. Romac Industries, Inc. Style 306. Or approved equal.

E. STAINLESS STEEL (SST)

1. Pipe shall conform to ASTM A312, Type 304L, Schedule 40. Pipe sizes and wall thickness shall conform to ANSI B36.19.

2. Joints: Butt-welded or threaded typical, or flanged at equipment, as required or shown on the Drawings.

3. Fittings: Butt or socket welded, threaded, or flanged as required or shown on the Drawings. Same material, and wall thickness as the connecting piping, conforming to ANSI B16.9. Pickled and passivated.
   a. Threaded: ASTM A182 in conformance with ASME B16.11.
   b. Socket Welded: ASTM A182 in conformance with ASME B16.11.
   c. Butt Welded: ASTM A403 in conformance with ASME B16.9.

4. Unions: Threaded, butt or socket welded, ASTM A182 in conformance with ASME B16.11

5. Thread Lubricant: Use Teflon thread lubricating compound or Teflon tape.

F. Flanges:

1. ASTM A182, in accordance with ASME B16.5. Flat face or raised face as suits the adjoining valve, fitting, or equipment flange face.

2. Gaskets: full face, $^{1}/_{16}$-inch thick, conforming to ASME B16.5.

3. Bolts, Nuts, and Washers:
   a. Bolts, nuts, and washers shall be stainless steel conforming to ASTM A193, Grade B8M, for bolts and ASTM A194, Grade 8M, for nuts and washers. Provide washer for each nut.

G. Welding Electrodes: AWS 5.9, ER 316L/316Lsi. Or per AWS specifications for the metal alloys welded to SS pipe.

H. All stainless steel welds, heated areas of stainless steel plates or shapes, and heat affected zones of stainless steel welds shall be cleaned, descaled and passivated per ASTM A380.

2.03 FLEXIBLE CONNECTORS

A. Tag Numbers: EJ-4-1, EJ-4-2, EJ-5-1, EJ-5-2

B. Service: Low Pressure Air (LPA).

C. Flexible connectors to be installed on the intake and discharge piping to mitigate the transmission of vibration to the piping and allow for thermal expansion as applicable, suitable for the operating temperature and pressure.

D. Single wide flowing arch, EPDM, seamless nominal ¼-inch thick inner tube, polyester tire-cord and high-tensile steel reinforced, seamless nominal $^{1}/_{16}$-inch thick, integral flat face flanges. ANSI B16.5 Class 150 drilled flanges and hot dipped galvanized carbon steel retaining rings. Rated at for 300°F at 25 psig air service.

E. Manufacturer and Product: General Rubber, Style 1101. Or approved equal.

2.04 EXPANSION LOOP

1. Service: 8-inch LPA

2. End Fitting and Elbow: 304 Stainless steel, Schedule 40. End Fitting Configuration: flanged ends

3. Hose Material: 304 Stainless steel

4. Total Movement: ±1.5-inches

5. Manufacturer and Model. Flexicraft Industries. ML Loop 30800. Or approved equal.

2.05 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

A. TRX-Synlube by Ramco, Anti-Seize by Ramco, Jusk IT Husky Lube O'Seal. Or approved equal.

2.06 INSULATION - PIPING

A. Service: Indoors, at locations indicated on the Drawings (nominal pipe size, location, insulation thickness)

6-inch Low Pressure Air (LPA), Blower Discharge Piping, ½-inch thick
8-inch LPA, Process Area, ½-inch thick
8-inch LPA, Blower Intake Piping, 2-inch thick

1. ASTM C547, Type 1, pre-formed rigid, molded fiberglass pipe insulation. ASTM C518 Thermal Conductivity (k): 0.23 Btu·in/(hr·ft2·°F) at 75 degrees F.

2. Vapor Retarder Facing: white, polypropylene-coated, high density kraft paper bonded to an aluminum foil, reinforced with fiberglass yarn, with self-sealing longitudinal closure laps (SSL) and pressure sensitive tape butt strips.

3. PVC Jacketing: installed in high traffic areas as shown on the Drawings to provide additional protection to insulated pipe.
   a. 20 mil, high impact polyvinyl chloride (PVC), cut and curled for outside diameter of insulated pipe, with self-sealing lap tape.

4. Include accessories required for installation.

5. Manufacturer and Product: Johns Manville. Micro-Lok® HP Ultra. Or approved equal.

B. Service: Outdoors, Exposed 8-inch Blower Intake Piping

1. 2½-inch thick, rigid insulation formed or fabricated to fit tightly around all piping system components with no gaps between insulation and piping components and no uninsulated piping exposed for the run of pipe and appurtenances to receive insulation.

2. Material:
   a. Fabricated to shape for pipes, elbows, and fittings from continuous bun stock per ASTM C450 and ASTM C585

b. Surface Burning Characteristics, maximum: 25/450 flame spread/smoke developed, ASTM E84
c. K-factor, maximum: 0.19 BTU·in/hr·ft²·°F at 75°F mean temperature after 180 days of aging, ASTM C518
d. Density, minimum: 2.0 lb/ft^3, ASTM D1622
e. Water Absorption, maximum: 2.0 % by volume, ASTM C272
f. Water Vapor Permeability, maximum: 4.0 perm-inch, ASTM E96, Procedure A

3. Aluminum jacketing for pipes, elbows, and fittings
   a. ASTM C1729 Standard Specification for Aluminum Jacketing
   b. Standard Roll or Sheet Aluminum Jacketing.
      1) Properties: Bare surface, 3105/3003 alloy, H14 temper, 3 mil polyfilm moisture barrier
      2) Classification: Type I, Grade 1, Class A, 0.016-inch thick
   c. Ell-Jacs Plus Two-Piece Aluminum Elbows.
      1) Properties: Clear painted outer surface, 1100 alloy, 0 temper, polyfilm moisture barrier
      2) Classification: Type I, Grade 3, Class A, 0.024-inch thick
   d. Stainless steel banding: 0.020-inch thick and ¾-inch wide.

4. Manufacturer and Product: Johns Manville., Trymer™ 2000 XP, with Aluminum Jacketing Products.

2.07 IDENTIFICATION LABELS

A. Pipe Labels and Flow Direction Arrows:

1. Material: Manufacture from or encase in outdoor grade plastic or vinyl that will resist damage or fading from wash down, sunlight, mildly corrosive atmosphere, dirt, grease, and abrasion.

2. Message: See Piping Schedule.

3. Label, Lettering Size, and Color: ANSI A13.1.

B. Snap-Around Type: Size for finished outside diameter of pipe and insulation.

1. For 6-inch and larger diameter pipe: May furnish strap-on type fastened without use of tools, with plastic or Type 316 stainless steel straps.

2. Firmly grip pipe so labels remain fixed in vertical pipe runs.

C. Manufacturers and Products:

1. Seton Identification Products, Branford, CT; Setmark Pipe Markers.

PART 3 EXECUTION

3.01 STORAGE AND HANDLING

A. See specification Section 01 60 00 DELIVERY, STORAGE, AND HANDLING.

B. Store all piping materials as per the manufacturer's recommendations.

C. Ropes, fabric, or rubber-protected slings shall be used to handle pipe.

D. Pipe shall be handled in such a manner that it not be dragged over sharp or cutting objects.

3.02 EXAMINATION

A. Verify size, structure penetrations, material, joint types, elevation, horizontal location, and pipe service to be connected to piping, valves, and equipment. Do not proceed with installation until any unsatisfactory conditions have been corrected.

B. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

3.03 HOT-DIPPED GALVANIZED SURFACES REPAIR

A. Hot-dipped galvanizing shall be applied after rolled grooves are installed on piping, or hot dipped galvanized coating repaired after rolled groove installation in accordance with ASTM A780.

3.04 INSTALLATION

A. Pipe

1. Pipe, fittings, specials, flanges, gaskets and appurtenances shall be delivered, stored and installed per manufacturers' recommendation. Where manufacturer's recommendations are different than, or in conflict with the Contract Documents, higher requirement standard shall apply.

2. Pipe installation as specified in this section supplements AWWA M11.

3. All exposed piping shall be adequately supported with devices of appropriate design. Where details are shown in the drawings, the supports shall conform thereto and shall be placed as indicated; provided that support for all piping shall be complete and adequate regardless of whether or not supporting devices are specifically shown.

4. Do not support piping systems off the tanks and equipment to which it is connected. Piping systems are to be supported independent of the tanks and equipment to which it is connected.

5. All pipe, fittings, etc., shall be carefully handled and protected against damage, impact shocks, and free fall. All pipe handling equipment shall be acceptable to the OWNER. Pipe shall not be placed directly on rough ground but shall be supported in a manner which will protect the pipe against injury whenever stored at the site or elsewhere. Pipe and appurtenances shall be carried into position, and not dragged.

6. The CONTRACTOR shall maintain LPA pipe systems free of standing water at all times during construction.

7. At all times when installation of pipe is not in progress, all opening into the pipe and the ends of pipe shall be kept tightly closed to prevent entrance of animals and foreign materials. The CONTRACTOR shall maintain the inside of the pipe free from foreign materials and in a clean and sanitary condition until its acceptance by the OWNER.

8. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the CONTRACTOR.

9. The CONTRACTOR shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe.

10. Before installation, each pipe or fitting shall be thoroughly cleaned of any foreign substance.

B. Flanged Joints:

1. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe, aligned with connecting tank and equipment flanges, or as shown on the Drawings.

2. Prior to assembly all stainless steel bolts and nut threads shall be coated with a non-seizing compound by the CONTRACTOR.

3. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.

4. All flanged assemblies shall have washers installed on bolt head side and at each nut.

5. Use torque-limiting wrenches to ensure proper bearing and bolt tightness.

6. Use flat-face flange when joining with flat-faced ductile or cast iron flange.

7. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or re-tighten the bolts and nuts, and retest the joints.

8. Flange adapters shall be installed per the Manufacturer’s instructions as may be required for thin-metal pipe and fittings.

C. Threaded and Coupled Joints

1. Conform to ANSI B1.20.1.

2. Ream, clean, and remove burrs from threaded piping before making up joints. Apply thread lubricant to threaded ends before installing fittings, couplings, unions, or joints.

3. Produce sufficient thread length to ensure full engagement when screwed home in fittings.

4. Counter-sink pipe ends, ream and clean chips and burrs after threading.

5. Make connections with not more than three threads exposed.

D. Couplings

1. Install in accordance with manufacturer's written instructions.

2. Before coupling, clean pipe holdback area of oil, scale, rust, and dirt. Do not remove pipe coating. If damaged, repair before joint is made.

3.05 FLEXIBLE CONNECTORS AND EXPANSION LOOP

A. Install per the Manufacturer's instructions.

B. Install the flexible connectors (flanged expansion joints) against mating pipe flanges and install bolts so that the bolt head and washers are against the retaining rings of the flexible connectors, and per the Blower MANUFACTURER's instructions.

3.06 HANGERS AND SUPPORTS - INSTALLATION

A. See specification Section 40 05 07 and Structural Drawings for requirements.

3.07 PNEUMATIC TEST FOR LOW PRESSURE AIR PIPING

A. Fluid: Oil free dry air

B. Exposed piping:

1. Apply preliminary pneumatic pressure of 10 psig. Examine for leakage by applying soap-water mixture at joints and connections. Correct visible leakage.

2. Apply test pneumatic pressure of 20 psig. Examine for leakage by applying soap-water mixture at joints and connections.

3. Maintain test pneumatic pressure for 10-minutes, minimum, and for such additional time as necessary to conduct examinations for leakage. Correct visible leakage and retest.

3.08 PIPE INSULATION

A. Install insulation and fastening/seals, and jacketing per the Manufacturer's instructions on pipes designated to receive insulation on the **PIPING SCHEDULE** and as indicated on the Drawings.

B. Install insulation after pipe leakage testing is complete.

C. Apply insulation over clean and dry surface.

3.09 AS-BUILT (RED-LINES)

A. Per MASS Division 10 Article 4.19, CONTRACTOR shall maintain a current set of construction as-built drawings and specifications (red-lines) that reflect any changes, modifications, clarifications, additions, or deletions to the work of this section. As-built drawings and specifications information shall be provided to the OWNER at the completion of system start up and substantial completion.

3.10 IDENTIFICATION LABELS

A. Pipe Labels and Flow Indication Arrows:

1. Apply to indoor piping in accordance with manufacturer's instructions.

2. Locate at equipment connections, valves, wall and floor boundaries, and exposed pipe not normally in view.

3. At 8-feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.

3.11 PIPING SCHEDULE

Legend	Service	Size(s), Inch	Piping Material	Test Pressure, psig	Remarks
LPA	Low Pressure Air	½-1	SST	10 & 20	Insulation per Drawing notes
LPA	Low Pressure Air	6, 8	GSP	10 & 20	Insulation per Drawing notes

END OF SECTION

SECTION 40 05 07
HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Design, furnish all labor, materials, equipment and incidentals and install a complete system of pipe hangers, supports, concrete inserts and anchor bolts including all hanging and supporting devices for supporting non-buried piping as specified herein, in coordination with related specification Sections, and/or as shown on the Drawings.

B. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of the responsibility for providing them. Pipe supports indicated on the Drawings are shown only to convey the intent of the design for a particular location and are not intended to represent a complete system.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 QUALITY ASSURANCE

A. As applicable, meet the requirements of the most recent version of the following standards, regulations, and requirements as may be referenced in this Section and the Contract Documents.

B. ANSI/Manufacturers' Standardization Society (MSS). Standard Practice (SP).

1. SP-58 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

2. SP-69 Pipe Hangers and Supports - Selection and Application

3. SP-89 Pipe Hangers and Supports - Fabrication and Installation Practices

4. SP-127 Bracing for Piping Systems: Seismic-Wind-Dynamic Design, Selection, and Application

C. Occupational Safety and Health Administration (OSHA)

D. International Building Code. Seismic loading and bracing.

E. Uniform Plumbing Code (UPC) as amended and adopted by the State of Alaska

1.04 SUBMITTALS

A. Prepare, deliver, and process under provisions of Section 01 30 00. Requests for proposed substitute or "or-equal" equipment/systems/products will be considered in accordance with the provisions of Section 01 25 00.

B. Submit, in accordance with Division 01, complete sets of shop drawings of all items to be furnished under this Section. Submittals shall include complete layouts, schedules, location plans and complete total bill of materials for all pipe support systems.

C. Submittals shall include a representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable.

D. Submittals shall include complete piping drawings as submitted for each piping submittal indicating type of hanger and/or support, location, magnitude of load transmitted to the structure and type of anchor, guide and other pipe supporting appurtenances including structural fasteners.

E. Submit information on anti-seize compound. Anti-seize shall be NSF-61 certified.

F. Submit complete design data for pipe support systems to show conformance with this Section.

G. Support System Design

1. Engage the services of an independent registered professional engineer ordinarily engaged in the business of pipe support systems analysis, to analyze system piping and service conditions and to develop a detailed support system, specific to the piping material, pipe joints, valves and piping appurtenances proposed for use.

2. All calculations shall be stamped by a Professional Engineer licensed in the state of Alaska. Calculations shall be submitted for review by the Engineer.

3. The proposed systems engineer shall attend a conference with the Engineer, scheduled prior to any support systems design.

H. Quality Control. Provide the following:

1. Certification that pipe, valves, and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment.

2. Documentation of product(s) specified herein
   a. AIS Compliance.

1.05 DESIGN REQUIREMENTS

A. Furnish and install pipe hangers, supports, and/or bracing, whether or not indicated on the Drawings.

B. Pipe, valve, and process components and elements permanently attached to the structure shall be designed to transfer the component seismic forces specified in ASCE 7-10, Section 13.3.1 to the structure.

C. Support Load: Dead loads imposed by weight of pipes filled with water, except air pipes, including valves and appurtenances, plus pipe support system infrastructure. Safety Factor: Minimum of 5.

D. Seismic Design

1. International Building Code 2012, ASCE 7-05 “Minimum Design Loads for Buildings and Other Structures”.

2. Seismic Loads: Seismic anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of Alaska and submitted for review and approval of the Municipality of Anchorage Building Safety Department.
   a. Per ASCE 7-10, Chapter 15 and Section 15.7
      1) $S_S = 1.5$
      2) $S_1 = 0.683$
      3) Site Class = D
      4) Risk Category III

E. Pipe Support Systems:

1. Maximum Support Spacing and Minimum Rod Size: Per the pipe manufacturer’s recommendations, or as indicated below, or as otherwise detailed on the Drawings.

Pipe Material	Nominal Size	Spacing of Supports
Steel Pipe, Galvanized Steel Pipe, and Stainless Steel Pipe	1” and smaller	5 feet
	1-1/4” to 2”	7 feet
	Larger than 2”	10 feet
Copper Pipe	1" and smaller	5 feet
	1-1/4" and larger	8 feet
PVC/CPVC Pipe	1" and smaller	4 feet
	1-1/4" to 2"	4-1/2 feet
	2-1/2" to 3-1/2"	5 feet
	4" to 5"	6 feet
	6" and larger	7 feet
Ductile iron pipe	All sizes	8 feet
Fiberglass pipe	Less than 3"	8 feet
	3" and larger	10 feet
PVC and/or PE Hose and Tube	0.25” to 0.5”	Route inside rigid PVC carrier pipe
	0.75” – 1”	3 feet
	1.5” to 3”	4 feet
	4” to 6”	6 feet

2. Other Pipes and Special Situations: May require supplementary hangers and supports.

F. Sway Bracing: As required by the IBC or indicated on structural drawings.

G. Anchoring Devices: Design, size, and space support anchoring devices, including concrete piers, anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support. Anchors shall be sized by equipment supplier, but no less 1/2 inch minimum diameter. Anchor materials shall be carbon steel with hot dip galvanized (HDG) finish.

H. Existing Support Systems: CONTRACTOR may reuse existing support systems as proven adequate for new pipe installation.

1.06 DELIVERY, STORAGE AND HANDLING

A. See Section 01 60 00. Specific process piping requirements are included below.

PART 2 PRODUCTS

2.01 GENERAL

A. All of the equipment specified herein is intended to support the various types of pipe and piping systems shown on the Drawings. It shall be the responsibility of the Contractor to develop final details and any details associated with special conditions not already covered to meet the system conditions (in particular system temperatures and pressures) specified in the respective Division 40 Pipe Sections.

B. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces and all probable external forces such as equipment, pipe and personnel contact.

C. The Contractor may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work. Such an adjustment might involve minor change to a pipe centerline elevation so that a single trapeze support may be used.

D. Where flexible couplings are required at equipment, tanks, etc, the end opposite to the piece of equipment, tank, etc, shall be rigidly supported, to prevent transfer of force systems to the equipment. No fixed or restraining supports shall be installed between a flexible coupling and the piece of equipment.

E. All pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

F. Materials for Hangers and Supports:

1. All rods, clamps, hangers, hanger hardware, inserts, anchor bolts, brackets and components for interior pipe supports shall be of Carbon steel with hot dip galvanized (HDG) finish.

2. Interior clamps on plastic pipe shall be plastic coated.

3. Supports for copper pipe shall be copper plated or shall have a 1/16-in plastic coating.

4. All rods, clamps, hangers, hanger hardware, inserts, anchor bolts, brackets and components for exterior pipe, submerged pipe and pipe within outdoor structures shall be of Carbon steel with hot dip galvanized (HDG) finish.

G. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

H. All uninsulated non-metallic piping such as PVC, CPVC, etc, shall be protected from local stress concentrations at each support point. Protection shall be provided by Cushioned Clamp, carbon steel with HDG finish clamp, Manu, Cush-A-Nator, model HT46PS6GRG.

I. Where pipe hangers and supports come in contact with copper piping provide protection from galvanic corrosion by; wrapping pipe with 1/16-in thick neoprene sheet material and galvanized protection shield; isolators similar to Elcen, Figure No. 228; or copper plated or PVC coated hangers and supports. All stainless steel piping shall be isolated from all ferrous materials, including galvanized steel by use of neoprene sheet material and protection shields, similar to above methods.

J. Unless otherwise specified herein, pipe hangers and supports shall be standard catalogued components, conforming to the requirements of MSS-SP-58 and -69; and shall be as manufactured by:

1. Carpenter & Patterson, Inc., Woburn, MA

2. F&S Central, Brooklyn NY

3. Elcen Metal Products Co., Franklin Park, IL

4. Unistrut Northeast, Cambridge, MA

K. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary.

L. Expansion anchors shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, MN or Wej-it by Wej-it Expansion Products, Inc., Bloomfield, CO. Expansion anchors shall be carbon steel with hot dip galvanized (HDG) finish.

M. Hanger rods shall be carbon steel with hot dip galvanized (HDG) finish. The strength of the rod shall be based on its root diameter. Hanger rods shall be attached to concrete structures using concrete inserts similar to F&S, Figures 180, 571 or 150; or continuous concrete inserts per F&S. Inserts shall be carbon steel with hot dip galvanized (HDG) finish.

2.02 SINGLE PIPE HANGERS

A. Single pipes shall be supported by hangers suspended by hanger rods from concrete ceilings, bottom of trapeze hangers and wall mounted angle brackets.

B. Except as otherwise specified herein, pipe hangers shall be carbon steel with hot dip galvanized (HDG) finish, of the adjustable clevis type or as required.

C. Where pipes are near walls, columns, etc, and located an excessive distance from ceilings or underside of beams, carbon steel with HDG finish wall brackets similar to Carpenter and Patterson, Figure No. 69-68, 84 or 139 shall be used for hanging pipe.

2.03 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of carbon steel with hot dip galvanized (HDG) finish channel.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to F&S, Figures 158, 419, 160A, 160B as required. Material of construction shall be carbon steel with hot dip galvanized (HDG) finish. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe shall be anchored to control direction of movement or act as a thrust anchor.

2.04 WALL SUPPORTED PIPES

A. Single or multiple pipes located adjacent to walls, columns or other structural members, whenever deemed necessary, shall be supported using carbon steel with hot dip galvanized (HDG) finish wall brackets similar to Carpenter and Patterson, Figure No. 69-78, 84, or 134; or "C" channel with steel brackets similar to Unistrut pipe clamps. All members shall be securely fastened to wall, column, etc, using double expansion shields or other method as approved by the Engineer. Additional wall bearing plates shall be provided where required.

2.05 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut type-system as specified in Paragraph 2.06 below, they shall be supported in one of the following methods.

1. For pipes 1/4-in to 2-in in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported. The hanger ring shall be carbon steel with hot dip galvanized (HDG) finish or PVC clad depending on the supported pipe. The hanger ring shall be equal to Carpenter & Paterson, Figure No. 81 or 81CT. The anchor flange shall be carbon steel with hot dip galvanized (HDG) finish similar to Carpenter and Patterson, Figure No. 85.

2. For pipes equal to or greater than 2-in in diameter extended pipe clamps similar to Carpenter and Patterson, Figure No. 267 may be used. The hanger shall be attached to concrete structures using double expansion shields, or to carbon steel with HDG finish support members using lugs similar to Carpenter and Patterson, Figure No. 220.

3. Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be carbon steel with hot dip galvanized (HDG) finish similar to Carpenter and Patterson, Figure No. 126. Copper clad or PVC coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamps. Insulation shall not be damaged by clamp installation.

4. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding 12-ft shall be supported by base elbows/tees, clamps, brackets, wall rests and pipe collars, all located as required to ensure a rigid installation.

2.06 SPECIAL SUPPORTS

A. Pipe supports shall be provided for closely spaced vertical piping systems required to provide a rigid installation. The interval of vertical support spacing shall be as specified, but in no case shall vertical interval exceed 10-ft. The support system shall consist of a framework suitably anchored to floors or ceilings.

B. Vertical and horizontal supporting members shall be U shaped channels similar to Unistrut, Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps. All components shall be carbon steel with hot dip galvanized (HDG) finish.

C. For piping 3-in and smaller, the framework shall be as manufactured by the Unistrut Corporation; Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum or equal. For piping larger than 3-in, the support frame shall be fabricated from carbon steel with hot dip galvanized (HDG) finish shapes and secured through the use of expansion anchors.

D. The assemblies shall be furnished complete with all nuts, bolts and fittings required for a complete assembly including end caps for all unistruts members.

E. Supports shall be used to meet all criteria herein, regardless of whether or not indicated on the Drawings. No pipe shall be left unsupported whenever a change in direction of line or flow takes place. At least one support shall be provided between every two couplings. Supports shall be provided for all valves, meters, or other metallic appurtenances.

F. Relocate any hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.

G. Supporting of piping by wire, rope, wood or other makeshift devices will not be permitted.

H. Burning of holes in beam flanges or narrow members is not permitted.

I. Sway bracing of non-resiliently supported piping shall be in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Guidelines for Seismic Restraint of Mechanical Systems, except that fire protection piping shall be supported per NFPA requirements.

J. Fasten hanger rods to structural steel members with suitable beam clamps.

K. Protect pipe insulation at every hanger, support or guide of insulated piping with inserts and shields.

L. Where supported by pipe hangers from the ceiling or where lateral displacement of pipe is probable, pipelines shall be seismically braced laterally at every 20 feet, and braced longitudinally and laterally every 40 feet and at 90 degree bends. The seismic bracing shall consist of ⅜-inch carbon steel with HDG finish attached to the pipe hanger, ½-inch diameter all threaded carbon steel with hot dip galvanized (HDG) finish rod, ½-inch diameter flexible connector and eye rod inserted in the ceiling.

M. Support piping connections to equipment by pipe support, not the equipment.

N. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.

O. Do not install pipe supports and hangers in equipment access areas.

P. Install lateral supports for seismic loads at all changes in direction.

2.07 GROUT

A. Place non-shrink grout under floor supports, to make smooth, flat bearing surface, as required.

1. Premixed compound consisting of non-metallic aggregate, cement, water reducing, and plasticizing agents. Color to match concrete.

2. The Quikcrete Companies, Atlanta, GA; Quikrete® Commercial Grade FastSet™ #1585-09 or approved equal.

2.08 VIBRATION ISOLATION PADS

A. Type: Neoprene Waffle.

B. Manufacturers and Products:

1. Mason Industries, Inc., Anaheim, CA; Type W.

2. Korfund Dynamics (VMC), Bloomingdale, NJ; Korpad.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify size, structure penetrations, material, joint types, elevation, horizontal location, and pipe service to be connected to piping, valves, and equipment. Do not proceed with installation until any unsatisfactory conditions have been corrected.

B. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

3.02 ACCESSORIES:

A. Vibration Isolation Pad: Provide neoprene waffle isolation pad under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.

3.03 HANGER AND SUPPORT INSTALLATION

A. Carbon Steel with HDG Finish Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping.

C. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

3.04 FASTENER SYSTEM INSTALLATION:

A. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

B. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

E. Install lateral bracing with pipe hangers and supports to prevent swaying.

F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2½-inch and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

G. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-inches.

END OF SECTION

SECTION 40 05 50
VALVES AND OPERATORS

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section covers the Work necessary for the CONTRACTOR to furnish, install, test, and verify the function of valves, operators, and accessories as specified herein, in coordination with related specification Sections, and as shown on the Drawings.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

B. See Specification Section 43 11 21 HIGH EFFICIENCY TURBO BLOWERS for valves and piping appurtenances provided with the Blower Manufacturer's equipment package.

1.03 QUALITY ASSURANCE/REFERENCES

A. As applicable, meet the requirements of the most recent version of the following standards, regulations, and requirements as may be referenced in this Section and the Contract Documents.

1. American National Standards Institute (ANSI); American Society of Mechanical Engineers (ASME):
   a. B16.1 Cast Iron Pipe Flanges and Flanged Fittings
   b. B16.10 Face-to-Face and End-to-End Dimensions of Valves

2. American Society for Testing and Materials (ASTM)

3. Factory Mutual (FM)

4. National Electrical Manufacturers Association (NEMA)

5. Underwriters Laboratories (UL)

6. Alaska Department of Environmental Conservation (ADEC), Alaska Administrative Code (AAC)

7. International Building Code. Seismic loading and bracing.
   a. Design, size, and locate valve and operator support systems as required, whether or not indicated in Drawings.
   b. Support Load: Dead loads imposed by weight of valve filled with water and operator. Safety Factor: Minimum of 5.

8. Uniform Plumbing Code (UPC) as amended and adopted by the State of Alaska.

1.04 SUBMITTALS

A. Prepare, deliver, and process under provisions of Section 01 30 00. Requests for proposed substitute or "or-equal" equipment/systems/products will be considered in accordance with the provisions of Section 01 25 00.

B. Complete list of all deviations from the Drawings and Specifications.

C. Shop Drawings. Provide the following:

1. Product data sheets to include:
   a. Valve tag number
   b. Valve nominal size, end connections, and model number with complete part number build out identified for use in cross reference to manufacturers' product options
   c. Pressure Class and Flow Capability including headloss K and/or C_v values
   d. Valve weight and component materials of construction for
      1) Valve body, shaft, gate or disc, elastomers
   e. Valve coating and lining systems and including NSF 61 certification for lining, as applicable
   f. Valve venting details
   g. Valve torques: Operating and Seating/Unseating

2. Installation drawings
   a. Valve and actuator assembly dimensioned scale drawings.
   b. Intended valve and actuator orientations, upstream seat side of valve vs downstream side of valve, and opening direction.
   c. Indication of any component modifications to avoid interferences with adjacent fittings and equipment.

3. Field installation requirements
   a. Manufacturers' printed installation instructions for all assemblies and subassemblies.
   b. Special shipping, storage and protection and handling instructions.
   c. Orientation of installed valve and actuator, seat side of valve, and opening direction.
   d. Lifting points and weight of assembled components and each subassembly.
   e. Wiring diagrams for electric actuators.

4. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period.

D. Quality Control. Provide the following:

1. Factory testing results.

2. Project site functional test and results of performance confirmation checks per specification Section 01 46 50.

3. Installation, and Operation and Maintenance Manuals: Include:
   a. As-built/manufactured drawings.
   b. Equipment function, normal operating characteristics, limiting conditions, and troubleshooting guidance.
   c. Assembly, installation, alignment, and maintenance instructions.

d. Manufacturers recommended spare parts and special tools.
e. Maintenance schedule showing the required maintenance, frequency of maintenance, and other items required at each regular preventative maintenance period.

1.05 DELIVERY, STORAGE AND HANDLING

A. See Section 01 60 00. Specific valve and operator requirements are included below.

B. Care shall be taken in loading, transporting and unloading to prevent damage to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the OWNER.

C. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until after installation and connecting piping is completed.

D. All valves 3-inch and larger shall be shipped and stored on site until time of use with plastic, wood or plywood covers on each valve end.

E. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until the valve is installed and put into use.

F. Any corrosion in evidence at the time of acceptance by the OWNER shall be removed, or the valve shall be removed and replaced.

G. Store indoors in dry, clean area and as coordinated with OWNER or the Owner's Representative.

H. Handle large valves with slings rigged to avoid damage to exposed parts. Do not use actuators, handwheels, or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL

A. All valve construction, materials, and pressure ratings shall be selected to suit the system in which installed. Pressure rating and manufacturer's name shall be cast on each valve body. Flow directions or seat side of the valves shall be marked on the valve bodies. Where possible, valves shall be of one manufacturer.

B. CONTRACTOR shall be responsible for coordination of equipment dimensions, installation requirements, weights, and loadings with the listed manufacturers, and the incorporation of the selected equipment into the physical dimensional constraints of the building, within the limits of the structural concrete, piping arrangement and of other equipment or infrastructure within the Work space.

C. Valves are to include factory mounted operator, actuator, handwheel, chain wheel, extension stem, worm and gear operator, operating nut, chain, wrench, and accessories, as applicable, for complete operation.

D. Valves to open by turning counterclockwise.

E. Valve ends to suit adjacent piping.

F. The nominal size of valves to be installed is the same as the nominal diameter of the pipe to which they are connected.

G. Design, size, and locate valve and operator support systems as required, including seismic loading and bracing, whether or not indicated in Drawings. See Section 40 05 07 for requirements.

2.02 VALVES

A. Ball Valves

1. FV-110
   a. Service: Low Pressure Air (LPA); temperature 200 °F
   b. 1/4-inch to 4-inch, 2-piece, ASTM A351 CF8M stainless steel, full port, threaded ends, minimum Class 150, quarter turn, manual hand lever operator. Reinforced PTFE seats and PTFE stem seals.
   c. Manufacturer and Product: Flowtek. Series S80. Or approved equal.

B. Butterfly Valves

1. BFV-4-1, BFV-5-1
   a. Service: Low Pressure Air (LPA); temperature air intake: -11 °F – 67 °F.
   b. 8-inch manually operated intake butterfly isolation valve provided with a 24 VDC position switch providing each blower Local Control Panel with the status of intake BFV OPEN/CLOSED. CLOSED indication represents any valve position that is NOT the OPEN position (fully open valve).
      1) OPEN indication allows the blower to operate. CLOSED position does not allow the blower to operate, or will shut down an operating blower if the intake valve were closed during operation.
      2) BFV shall be lug type with A536 ductile iron body, 316 CF8M stainless steel disc, 416 stainless steel shaft, and EPDM seat rated for -40 °F – 275 °F. ANSI Class 125.
   c. Manufacturer and Products. Valve and position switch shall be completed product of the Valve supplier.
      1) Maxseal Inc.
         a) Performance Series Resilient Seated Butterfly Valve.
         b) Position Switch: Westlock Controls Accutrak Rotary Position Monitor with mounting accessories and brackets as required and suitable for the valve. Model 9468 S BY 2A 2M12 00.
      2) Or approved equal.

2. BFV-4-2, BFV-5-2
   a. Service: Low Pressure Air (LPA); temperature discharge: 200 °F.
   b. 6-inch manually operated blower discharge butterfly isolation valve. BFV shall be lug type with A536 ductile iron body, 316 CF8M stainless steel disc, 416 stainless steel shaft, and EPDM seat rated for -40 °F – 275 °F. ANSI Class 125.
      a) Manufacturer and Product: Maxseal Inc., Performance Series Resilient Seated Butterfly Valve. Or approved equal.

C. Check Valves

1. CV-4-1, CV-5-1
   a. Service: Low Pressure Air (LPA); temperature discharge: 200 °F.
   b. 6-inch wafer style, dual disc check valve to be installed on the discharge piping from each Blower. ASTM A126 Grade B cast iron body and internals, 316 stainless steel spring, EPDM seat. Include gaskets for mounting between mating flanges.

2. Manufacturer and Product: US Valve Dual Disc Wafer Check Valve, 09-2-4 SLE. Or approved equal.

2.03 OPERATORS

A. Manual Valve Operator:

1. Operator force not to exceed 40 pounds under any operating condition, including initial breakaway. Gear reduction operator when force exceeds 40 pounds.

2. Operator self-locking type or equipped with self-locking device.

3. Position indicator on quarter-turn valves.

4. Worm and gear reduction operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threaded steel reach rods with internally threaded bronze or ductile iron nut.

2.04 ACCESSORIES

1. Tagging: Provide a 1½-inch diameter 316 stainless-steel tag for each valve operator.

PART 3 EXECUTION

3.01 STORAGE AND HANDLING

A. See Section 01 60 00. Specific valve and operator requirements are included below.

B. Store and handle valves and operators per the manufacturer’s recommendations.

3.02 EXAMINATION

A. Verify that dimensions are correct and Project conditions are suitable for installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.03 INSTALLATION

A. Prior to assembly all stainless steel bolts and nut threads used in the Work shall be coated with a non-seizing compound by the CONTRACTOR.

B. Valves

1. Valves shall be installed in strict accordance with manufacturer's recommendations.

2. Flange Ends:
   a. Provide flat face flanges. Raised face flanges are not acceptable.
   b. Flanged valve bolt holes shall straddle vertical centerline of pipe.
   c. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

3. Screwed Ends: Clean threads by wire brushing or swabbing and apply joint compound.

4. Valve Location and Orientation:
   a. Locate and orient valves to provide accessibility for control and maintenance.

3.04 PRESSURE/LEAKAGE TESTING AND DISINFECTION

A. Valves shall be tested in conjunction with piping system pressure testing and disinfection. See Section 40 05 01.

3.05 TESTS AND INSPECTION

A. Test valves for smooth open and close with operating pressure on one side and atmospheric pressure on the other. Perform test in both directions for valves which are subject to pressure on both sides.

B. Record number of turns to open and close valve; account for any discrepancies with manufacturer's data.

C. Under all operating conditions, valve shall be leak tight.

END OF SECTION

SECTION 40 90 00
PROCESS CONTROL AND INSTRUMENTATION SYSTEMS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide all Process Control and Instrumentation Systems (PCIS), complete and operable, in accordance with the Contract Documents.

B. The requirements of this Section apply to all components of the PCIS, unless indicated otherwise.

C. Responsibilities

1. The CONTRACTOR, through the use of the Blower System Manufacturer and qualified electrical and mechanical installers, shall be responsible to the OWNER for the implementation of the PCIS and the integration of the PCIS with other required instrumentation and control devices.

2. Due to the complexities associated with the interfacing of numerous control system devices, it is the intent of these Specifications that the Blower System Manufacturer be responsible to the CONTRACTOR for the integration of the PCIS with devices provided under other Sections, with the objective of providing a completely integrated control system free of signal incompatibilities.

3. As a minimum, the CONTRACTOR shall perform the following Work:
   a. Implementation of the PCIS
      1) prepare the test plan, the training plan, and the spare parts submittals
      2) procure hardware
      3) oversee and certify hardware installation
      4) oversee, document, and certify loop testing
      5) prepare as-built drawings

4. The Blower System Manufacturer shall be responsible for all programming of packaged blower units and configuration of the local Operator Interface (OI) display terminals on these units.

5. The Blower System Manufacturer shall be responsible for control programming, Operator Interface display configuration, testing and certification of the Blower Systems.

6. The OWNER’s ENGINEER will be responsible for integration of new blowers into facility SCADA System and existing iFix Human Machine Interface (HMI) graphical display system. The Blower Manufacturer shall configure, document and test data table mapping in the Blower Systems for remote acquisition by facility SCADA system.

7. Blower system and associated instrumentation and controls supplied under Specification Section 43 11 00 shall be installed in accordance with this specification.

D. Control System Panel Designer and Fabricator

1. Control System Panel Designer and Fabricator (CSPDF): The blower control panels, and all other panels that have PLC hardware or communication hardware within them, shall be fabricated by CSPDF. The CSPDF shall be the Blower System Manufacturer or, approved, third party control panel fabricator. The CSPDF or Blower Manufacturer shall perform the following Work:
   a. Edit submittal drawings to show any and all changes to the design.
   b. Fabricate and test the panel(s) at the factory. Testing will be may be witnessed at the discretion of the OWNER or their representative.
   c. Ship the panels with a copy of the as-built drawings.

2. CSPDF Qualifications: The CSPDF shall have the resources, space, and personnel needed to design and fabricate the panels. The CSPDF shall meet the following minimum qualifications:
   a. The CSPDF shall have been in the business of building panels and bonding the construction of these panels for at least 5 years. The bonding shall be under the name and ownership of the company fabricating the panels for this Project.
   b. The CSPDF shall build the panels to UL standard 508A, shall be certified to build panels to UL standard 508A, and shall attach a UL label on all new panels, or the panel builder shall build to an equal standard, shall be certified to an equal standard, and shall attach a label to all new panels with a label that is acceptable to the Municipality of Anchorage Building Department.

1.02 REFERENCE DOCUMENTS

A. NFPA 70 – National Electrical Code, current adopted version.

1.03 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 30 00 and the following:

1. The CONTRACTOR shall coordinate the instrumentation Work so that the complete instrumentation and control system shall be provided and shall be supported by accurate Shop Drawings and as-built drawings.

2. Exchange of Technical Information: During the period of preparation of these submittals, the CONTRACTOR shall authorize a direct, informal liaison with the ENGINEER for exchange of technical information. As a result of this liaison, certain minor refinements and revisions in the systems as indicated may be authorized informally by the ENGINEER, but shall 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 Contract Drawings shall be employed exclusively throughout Shop Drawings, and similar materials. No other symbols, designations, or nomenclature unique

to the manufacturer's standard methods shall replace those prescribed above, used herein, or on the Contract Drawings.

B. Shop Drawings

1. General
   a. Shop Drawings shall include the letterhead or title block of the equipment supplier. The title block shall include, at a minimum, the equipment supplier's registered business name and address, Project name, drawing name, revision level, and personnel responsible for the content of the drawing. The quantity of submittal sets shall be as indicated in MASS Section 10.05 Article 5.6.
   b. Organization of the Shop Drawing submittals shall be compatible with eventual submittals for later inclusion in the Technical Manual.
   c. Shop Drawing information shall be bound in standard size, three-ring, loose-leaf, vinyl plastic, hard cover binders suitable for bookshelf storage. One set of drawings 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 shall be attached to the inside of the front panel door.
   d. Interfaces between instrumentation, motor starters, valves, variable speed drives and other equipment related to the PCIS shall be included in the Shop Drawing submittal.
   e. Priced list of all spare parts for all devices.

2. Test Procedure Submittals
   a. The CONTRACTOR shall submit the proposed procedures to be followed during tests of the PCIS and its components.
   b. Preliminary Submittal: Outlines of the specific proposed tests and examples of proposed forms and checklists.

3. The CONTRACTOR shall provide a submittal of the CSPDF's certifications, P.E. licenses, and project history before submitting any Shop Drawings or commencing any Work on the control panels.

C. As-Built Drawings

1. The CONTRACTOR shall keep current a set of complete loop and schematic diagrams which shall include all field and panel wiring, piping and tubing runs, routing, mounting details, point to point diagrams with cable, wire, tube and termination numbers. These drawings shall include all instruments and instrument elements. 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 OWNER.

2. The ENGINEER will provide a copy of the CAD drawings for the Project to the CONTRACTOR for use in shop drawing and as-built drawing preparation.

1.04 WARRANTY

A. The Contractor shall warranty all materials and workmanship for two (2) years from the Final Acceptance Date.

PART 2 PRODUCTS

2.01 GENERAL

A. Code and Regulatory Compliance: PCIS Work shall conform to or exceed the applicable requirements of the National Electrical Code and local building codes.

B. Current Technology: Meters, instruments, and other components shall be the most recent field-proven models marketed by their manufacturers at the time of submittal of the Shop Drawings, unless otherwise required to match existing equipment.

C. Hardware Commonality: Instruments which utilize a common measurement principle (for example, d/p cells, pressure transmitters, level transmitters which monitor hydrostatic head) shall be furnished by a single manufacturer. Panel-mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be from a single manufacturer.

D. 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 sufficient power to each loop component. Power supplies shall be mounted within control panels or in the field at the point of application.

E. 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. Signal conditioners and converters shall be provided where required to resolve any signal level incompatibilities or provide required functions.

F. Environmental Suitability: 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 CONTRACTOR shall provide power wiring for these devices. Enclosures suitable for the environment shall be furnished. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.

G. 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 signals outside control panels shall be 4 to 20 mA DC, except as indicated. Electric signals shall be electrically or optically isolated from other signals.

H. Alternative Equipment and Methods: Equipment or methods requiring redesign of any Project details are not acceptable without prior written approval of the ENGINEER through the "or equal" process of MASS Section 10.05 Article 5.7. Any proposal for approval of alternative equipment or methods shall include evidence of improved performance, operational advantage and maintenance enhancement over the equipment or method indicated, or shall include evidence that

an indicated component is not available. To match existing equipment and future equipment being installed under other contracts, equipment substitutions for equipment specified as no equal will not be accepted.

2.02 OPERATING CONDITIONS

A. The PCIS shall be designed and constructed for satisfactory operation and long, low maintenance service under the following conditions:

1.	Environment	-	Wastewater treatment facility
2.	Indoor Temperature Range	-	32 through 84 degrees F
3.	Relative Humidity	-	20 through 90 percent, non-condensing
4.	Seismic Design Category D		

2.03 SPARE PARTS AND SPECIAL TOOLS

A. The CONTRACTOR shall provide the following:

1. Spare parts as listed in equipment specifications in Division 40.

2. 5 ea. Spare fuses of each type used in each control panel supplied for the Project.

3. 2 each spare relays for each type used in panel.

4. 2 ea. spare relay base for each type used in panel.

B. The CONTRACTOR shall furnish a priced list of all special tools required to calibrate and maintain the instrumentation provided under the Contract Documents. After approval, the CONTRACTOR shall furnish tools on that list.

C. Special tools and spare parts shall be submitted before startup commences, suitably wrapped and identified.

PART 3 EXECUTION

3.01 PRODUCT HANDLING

A. Shipping Precautions: After completion of shop assembly, factory test, and approval, equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weight shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the site.

B. 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.

C. 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 shall be prominently displayed on the outside of the package. Each HART device shall have the PID number programmed into smart HART protocol memory. The complete tag shall be the instrument drawing tag shown on the Contract Drawings.

D. 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.

3.02 INSTALLATION

A. General

1. Instrumentation, including instrumentation furnished under other Divisions, shall be installed under Division 40 and the manufacturers' instructions.

2. Equipment Locations: The monitoring and control system configurations indicated are diagrammatic. The locations of equipment are approximate. The exact locations and routing of wiring and cables shall be governed by structural conditions and physical interferences and by the location of electrical terminations on equipment. Equipment shall be located and installed so that it will be readily accessible for operation and maintenance. Where job conditions require reasonable changes in approximated locations and arrangements, or when the OWNER exercises the right to require changes in location of equipment which do not impact material quantities or cause material rework, the CONTRACTOR shall make such changes without additional cost to the OWNER.

B. Conduit, Cables, and Field Wiring

1. Conduit shall be provided under Division 26.

2. Process equipment control wiring, 4-20 mA signal circuits, signal wiring to field instruments, PLC input and output wiring and other field wiring and cables shall be provided under Division 26.

3. PLC equipment cables, Control Area Networks shall be provided under Division 26.

4. Terminations and wire identification at PCIS equipment furnished under this or any other Division shall be provided in accordance with Divisions 26 an 40.

C. Instrumentation Tie-Downs: Instruments, control panels, and equipment shall be anchored by methods that comply with seismic requirements applicable to the site.

D. Ancillary Devices: The CONTRACTOR shall be responsible for providing connections as required by the instruments and specific installation requirements.

E. Installation Criteria and Validation: Field-mounted components and assemblies shall be installed and connected according to the requirements below:

1. Installation personnel have been instructed on installation requirements of the Contract Documents.

2. Technical assistance is available to installation personnel at least by telephone.

3. Installation personnel have at least one copy of the approved Shop Drawings and data.

4. Flexible cables and capillary tubing shall be installed in flexible conduits. The lengths shall be sufficient to withdraw the element for periodic maintenance.

5. Power and signal wires shall be terminated with crimped type lugs.

6. Connectors shall be, at a minimum, watertight.

7. Wires shall be mounted clearly with an identification tag that is of a permanent and reusable nature.

8. Wire and cable shall be arranged in a neat manner and securely supported in cable groups and connected from terminal to terminal without splices, unless specifically approved by the ENGINEER. Wiring shall be protected from sharp edges and corners.

9. Mounting stands and bracket materials and workmanship shall comply with requirements of the Contract Documents.

10. Verify the correctness of each installation, including polarity of electric power and signal connections, and make sure process connections are free of leaks. The CONTRACTOR shall certify in writing that discrepancies have been corrected for each loop or system checked out.

11. The OWNER shall not be responsible for any additional cost of rework attributable to actions of the CONTRACTOR or related suppliers.

3.03 CALIBRATION

A. General: Devices provided under Division 40 shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.

B. Calibration Points: Each instrument shall be calibrated at 20, 60, and 100 percent of span using test instruments to simulate inputs. The test instruments shall have accuracies traceable to National Institute of Testing Standards.

C. Bench Calibration: Instruments that have been bench-calibrated shall be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, shall be made only after consultation with the ENGINEER.

D. Field Calibration: Instruments that were not bench-calibrated shall be calibrated in the field to ensure proper operation in accordance with the instrument loop diagrams or specification data sheets.

E. Calibration Sheets: Each instrument calibration sheet shall provide the following information and a space for sign-off on individual items and on the completed unit:

1. Project name
2. Loop number
3. Tag number
4. Manufacturer
5. Model number
6. Serial number
7. Calibration range
8. Calibration data: Input, output, and error at 20 percent, 60 percent and 100 percent of span
9. Switch setting, contact action, and deadband for discrete elements
10. Space for comments
11. Space for sign-off by supplier and date
12. Test equipment used and associated serial numbers

3.04 LOOP TESTING

A. Valve Tests: Valves shall be stroked and adjusted to verify proper control action, limit switch setting and remote feedback of valve status.

B. Instrument and Instrument Component Validation: Each instrument shall be field-tested, inspected, and adjusted to its indicated performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or, in the absence of a Contract requirement, any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the ENGINEER and at the CONTRACTOR’s expense.

C. Loop Validation: Controllers and electronic function modules shall be field-tested and exercised to demonstrate correct operation of the hardware and wiring. Control loops shall be checked under simulated operating conditions by impressing input signals at the primary control elements

and observing appropriate responses at register in the PLC processor. Actual signals shall be used wherever available. Following any necessary corrections, the loops shall be retested.

D. Loop 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.

3.05 PERFORMANCE TEST

A. The entire PCIS hardware, field instruments, power supplies, and wiring shall operate for 30 days without failure.

B. The CONTRACTOR shall furnish support staff as required to satisfy the repair or replacement requirements.

C. If any component, other than field instruments, fails during the performance test, it shall be repaired or replaced and the PCIS shall be restarted for another 30-day period.

3.06 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

A. For the purpose of this Section, the following conditions, in addition to the requirements in MASS Division 10, 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. Punch-list items have been corrected.

5. Revisions to the project documents that may have resulted from the field tests have been made and reviewed.

6. Debris associated with installation of instrumentation has been removed.

7. Probes, elements, sample lines, transmitters, tubing, and enclosures have been cleaned and are in like-new condition.

END OF SECTION

SECTION 40 95 13
CONTROL PANELS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. General: The CONTRACTOR shall provide control panels, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 90 00 apply to this Section.

C. The provisions of this Section apply to local panels provided in equipment systems specified in other Sections, unless indicated otherwise in those Sections.

D. Control and SCADA panels shall be built in accordance with UL508A, or an equivalent standard acceptable to the local code enforcement agency having jurisdiction. The panel fabricator shall carry a current certification with a Nationally Registered Testing Laboratory (NTRL) indicating their qualification to build and certify control panels in accordance with the applicable standards. The panels shall have NTRL labels attached to them by the panel builder. The panel builder shall provide with each panel a certification from the independent testing lab inspector that the panel is built to their standards.

E. Control panel enclosures shall be built to NEC standards for enclosures.

F. Blower system and associated industrial control panels supplied under Specification Section 43 11 00 shall be implemented in accordance with this specification.

1.02 REFERENCE DOCUMENTS

A. UL 508A – Standard for Industrial Control Panels

B. NFPA 79 – Electrical Standard for Industrial Machinery

C. NFPA 70 – Article 409

1.03 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.04 SUBMITTALS

A. General: Submittals shall be furnished in accordance with MASS Section 10.05 Article 5.6.

B. Control Panel Engineering Submittal: The CONTRACTOR shall submit a control panel engineering submittal (CPES) for each control panel and enclosure provided under Division 40. The CPES shall completely define and document the construction, finish, fuses, circuit breakers,

internally-mounted hardware, communications hardware, and PLC system components. All panel drawings shall, at 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 within 60 calendar days after Notice to Proceed, and shall have the following contents:

1. A complete index shall appear in the front of each bound volume. All drawings and data sheets associated with a panel shall be grouped together with the panels being indexed by systems or process areas. All panel tagging and nameplate nomenclature shall be consistent with the requirements of the Contract Documents.

2. Scale construction drawings which define and quantify the type and gauge of steel to be used for panel fabrication, the ASTM grade to be used for structural shapes and straps, panel door locks and hinge mechanisms, type of bolts and bolt locations for section joining and anchoring, details and proposed locations for "UNISTRUT" members, stiffener materials and locations, electrical terminal box and outlet locations, electrical access locations, print pocket locations, writing board locations, and lifting lug material and locations.

3. Cutout locations with nameplate identifications shall be shown.

4. The Contract Drawing wiring diagrams shall be edited to identify electrical devices, terminals, and interconnecting wiring. These diagrams shall show interconnecting wiring by lines, designate terminal assignments, and show the physical location of all electrical and control devices.

5. A bill of material which enumerates all devices associated with the control panel.

PART 2 PRODUCTS

2.01 GENERAL

A. Environmental Suitability: All indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided as shown on the Drawings in order to maintain all instrumentation devices 20 percent within the minimums and maximums of their rated environmental operating ranges. The CONTRACTOR shall provide all power wiring for these devices. Enclosures suitable for the environment shall be provided. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.

B. Panel construction shall conform to NFPA 70 (NEC) Article 409 and NFPA 79.

C. The control panel control voltage shall be 24 VDC or as shown on the drawings. Control conductors shall be provided in accordance with the indicated requirements.

D. The control panel shall be the source of power for any 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.

E. Unless indicated otherwise, control panels shall be housed in NEMA-rated enclosures as shown on the Drawings. Control panels shall be either wall-mounted, pedestal-mounted or equipment skid-mounted, as indicated. Internal control components shall be mounted on an internal back-panel or side-panel as required.

1. All interior control or relay panels mounted above ground level shall be NEMA 12.

2. All control or relay panels mounted below ground level, unless noted otherwise on the Drawings, shall be NEMA 4X.

F. Each source of 'external' voltage shall be isolated by providing disconnecting fused terminal blocks or DIN rail mounted relays. Each control panel shall be provided with identified terminal strips for the connection of all external conductors. The CONTRACTOR shall provide sufficient terminal blocks as shown on the Drawings.

G. Motor starters, where required, shall be in accordance with Section 26 24 19, or as shown on the drawings. Each motor starter shall be provided with PLC interface circuits as indicated on the drawings. Electrical components shall be of standard American manufacture.

H. Discrete outputs from the control panels shall be provided by electrically isolated contacts rated for 2 amps at 24 VDC or 5 amps at 120 VAC, or as shown on the drawings.

I. All control panel mounted devices shall be provided as shown on the Drawings.

J. Painting: Steel control panels shall be thoroughly cleaned and sand blasted per Steel Structures Painting Council Specification SSPC SP 6 (Commercial Blast) after which surfaces shall receive a prime coat of Amercoat 185, or equal, 3 mils DFT, for a total thickness of the prime plus finish system of 6 mils. The finished color of the outside surfaces shall be ANSI 61 gray paint. Interior of the control panel, back-panel, and side-panels shall have a white finish coat.

2.02 CONTROL PANELS

A. NEMA 4X

1. Enclosure shall be 16-gauge or 14-gauge thickness, unless otherwise indicated on the Drawings, Type 316L stainless steel.

2. Enclosures shall have stainless steel hinges, hinge pins, and door clamps.

3. Finish shall be unpainted, smooth #4 brushed finish, as specified for steel control panels.

4. Enclosures and Panels shall be as manufactured by Hoffman, or equal.

B. NEMA 12

1. Steel panel section faces shall be No. 14 gauge minimum thickness, unless otherwise indicated on the Drawings. All materials shall be selected for levelness and smoothness.

2. Structural shapes and strap steel shall comply with ASTM A 283 – Low and Intermediate Tensile Strength Carbon Steel Plates, Grade C.

a. Bolting Material: Bolting material shall be 316 SST. 316 SST carriage bolts shall be used for attaching end plates. All other bolts shall be hex end machine bolts.

3. Construction: Dimensions shall be as shown on the Drawings.

C. Fabrication

1. End plates, top plates, and top closure panels (to hung ceiling) shall be provided when required. End plates, top plates, and top closure panels shall be removable with countersunk bolts to match panels. Top closure panels shall be furnished in lengths that match the widths of standard panels, except that one top closure panel may extend across two 4 feet 6 inches wide or five 2 feet wide standard panels. The vertical joints of these panels shall align with the vertical joints of the standard panels.

2. Doors shall be flush-fitting, gasketed, and be of the hinged type with door handles. Screwdriver 1/4 turn or Dzus type fasteners are not acceptable.
   a. The flanged edges of all panels shall be straight and smooth. Corners shall be welded and ground smooth.
   b. The face of the panel shall be true and level after flanging.
   c. All panel cut outs and holes may be cut or drilled by any standard method that does not cause deformation. Burrs shall be ground smooth.
   d. Adjacent panels shall assemble with faces flush. Gaps or cracks shall not be visible from the front of the assembled instrument board.
   e. Stiffeners shall be welded to the back of panels, as required to prevent panel deformation due to the weight of face-mounted instruments.
   f. Panels shall be self-supporting as defined below.

D. Framework and Supports

1. The rear of each panel section shall have a steel framework assembled to it for supporting conduit, wireways, switches, piping, and all instrument accessory items such as relay or terminal enclosures, transducers, pressure switches, valves, and air relays. The main framework shall be constructed of standard structural shapes. Special shapes such as "Unistrut" may be used for secondary supports. Framework must neither interfere with instrument connections nor interfere with access needed for maintenance or adjustments.

2. Steel framework shall extend 2 feet 4 inches back from the panel face, or as indicated in the material requisition. Where indicated, individual adjustable leg supports shall be provided at the back of the framework so that the entire panel is self-supporting.

E. Preparation of Panel Surface

1. The following requirements apply to the front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all holes or cut outs.
   a. All high spots, burrs, and rough spots shall be ground smooth.
   b. The surfaces shall be sanded or sandblasted to a smooth, clean, bright finish.
   c. All traces of oil shall be removed with a solvent.
   d. The first coat of primer shall be applied immediately.

F. Instrument Finishing: The final coats applied to painted surface of instrument cases, doors, or bezels that are visible from the front of panels shall be manufacturer's standard, unless otherwise indicated. Black japan or "crinkle" finishes on instrument cases are not acceptable.

G. Mounting of Instruments

1. The panel vendor shall provide cut outs, and shall mount all instrument items indicated to be panel-mounted, including any instruments indicated to be furnished by other vendors but installed in the panel.

2. The panel vendor shall also mount behind the panels other instrument accessory items as required for functionality or as indicated.

3. Equipment mounted at the rear of panel shall be installed to allow for commissioning adjustments, servicing requirements, and cover removal.

4. Spare space shall be kept clear of wiring, etc., to give maximum space for future additions.

H. Electrical Requirements

1. The CONTRACTOR shall provide conduit, wireways, switches, wire, and electrical fittings for all 24 VDC, 120 VDC and 120 VAC circuits to instruments and other electrical devices as required for a complete and operable installation.

2. Conduit, wireways, junction boxes and fittings shall include those required between sensors and transmitters and between the junction boxes and instruments.

3. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. Terminals shall be modular, DIN rail mounted, rated at 300 VAC minimum, manufactured by Allen-Bradley, Weidmuller, or equal.

4. Wiring Methods: Wiring methods and materials for all panels shall be in accordance with the N.E.C. requirements for General Purpose (no open wiring) unless otherwise indicated.

5. Signal and Control Circuit Wiring
   a. Wire type and sizes: Conductor shall be flexible stranded copper wire, UL. Wires for instrument signal circuits and alarm input circuits shall be No. 16 AWG Type MTW rated for 600 volts.
   b. Wire Insulation Colors:
      1) 120 VAC Power - Black 14 AWG minimum
      2) 120 VAC Neutral - White 14 AWG minimum
      3) 120 VAC Ground - Green 14 AWG minimum
      4) 120 VAC Foreign Power - Yellow 16 AWG minimum
      5) 120 VAC Foreign Neutral - Yellow 16 AWG minimum
      6) 24 VDC Positive - Blue 16 AWG minimum
      7) 24 VDC Common – White with Blue Stripe 16 AWG minimum
   c. Wire Marking: Provide heat-shrinkable nylon machine printed wire labels. Wires shall be marked as shown on the Drawings. Numbers shall read from left to right.
   d. Flexible conduit is only to be used where specified.
   e. Conduit fittings shall be Crouse Hinds cast fittings, or equal.

f. For equipment grounding, panels shall be provided with a 1/4 inch by 1 inch copper ground bus complete with solder-less connector for one No. 4 AWG bare stranded copper cable. The copper cable shall be provided by the CONTRACTOR and be connected to the electrical equipment ground of the panel supplying power.

6. Power Supply Wiring
   a. Unless otherwise indicated, all instruments, alarm systems, and motor controls shall operate on 24 VDC 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.

I. 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 0.25 Amp rapid blow 250-volt fuse for all analog circuits and all discrete input circuits. The analog terminals shall be Allen-Bradley 1492-JDG3FB, and the discrete input terminal shall be 1492-JD3FB

J. Spare Fuses: For each panel, provide the following spare fuses:

1. A minimum of five spare fuses of each size

2. One spare fuse for every ten fused circuits

Provide the fuses in a spare fuse box mounted on the interior wall of the panel. Fuse box shall be Plano Tackle Systems 1061 Accessory Box, Plano, IL, www.planomolding.com, or equal.

2.03 MARKING

A. Control panels shall be marked with the following information that is plainly visible after installation:

1. Manufacturer’s name

2. Supply voltage

3. Rated ampacity

4. Short-circuit rating of the main breaker

5. Name of the project and site

6. Enclosure rating

7. Fuse table with replacement fuse requirements

8. Terminal torque information

9. Other labelling as required by UL-508A

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation for Shipment and Shipping

1. Panels shall be crated for shipment using a heavy framework and skids. Panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. Instruments that are shipped with the panel shall further have suitable shipping stops and cushioning material installed to protect parts that could be damaged due to mechanical shock. Each separate panel unit shall be provided with removable lifting lugs to facilitate handling.

2. All control panel factory testing and inspection shall be performed prior to shipping.

3. Control panels shall be installed in accordance with Section 40 90 00.

3.02 PENETRATIONS

A. All penetrations in underground vaults or NEMA 4X areas shall be bottom entry.

3.03 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 Contract Drawings. These designators shall be marked on all conductors at every terminal. Wire markers shall be nylon, heat-shrinkable and machine-printed.

3.04 CALIBRATION, TESTING, AND INSTRUCTION

A. General: Calibration, testing, and instruction shall be performed in accordance with Section 40 90 00.

B. Inspection and Approval

1. Panel fabricator shall conduct the following tests prior to arrival of the ENGINEER or before shipment, if the ENGINEER chooses not to witness factory testing.
   a. All status, control, analog and alarm circuits rung out to determine their operability.
   b. All electrical power circuits checked for continuity and where applicable, operability.
   c. Any other test required to place the panel in an operating condition.

2. It shall be the responsibility of the CONTRACTOR to furnish all necessary testing devices and sufficient manpower to perform the tests required by the ENGINEER.

3. Field Testing: Each control panel shall be tested again for functional operation in the field after the connection of external conductors and prior to equipment startup.

END OF SECTION

SECTION 43 11 21
HIGH EFFICIENCY TURBO BLOWERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnish, install, functional test, and provide startup services for two (2) CSA/UL/CE Listed and labeled, factory assembled high speed, dual layer bump foil air bearing, turbo blower systems complete and functional with interconnection piping and valves, electrical and control systems, and appurtenances. The pre-packaged blower units shall be complete, including sound enclosure, permanent magnet synchronous motors, variable frequency drives, thermal-magnetic main circuit breaker/disconnect with electronic trip unit, local control station, programmable logic controller (PLC), inlet flange boxes, inlet air filter, discharge expansion cones, combining headers, blow-off valves and blow-off silencers, and other appurtenances as described herein and as shown on the Drawings, and as needed for complete and functional pre-packaged blower units.

B. Furnish and install pipe spools, elbows, bolts, washers, lock-washers nuts, and gaskets needed to install the loose appurtenances.

C. One (1) combination air intake filter system shall serve both blowers. See specification Section 43 15 13. Air intake filter system head losses shall be included by the Blower MANUFACTURER in their submitted blower performance calculations.

D. Each blower shall be provided with inlet valves with position switches, discharge check valves, discharge isolation valves, and expansion joints. See specification Sections 40 05 01 and 40 05 50. Air head losses of these valves and appurtenances shall be included by the Blower MANUFACTURER in their submitted blower performance calculations.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 QUALITY ASSURANCE/REFERENCES

A. Single source responsibility: All equipment, instruments, and other products specified in this Section shall be furnished by one supplier.

B. Equipment shall, as applicable, meet the current requirements of the following industry standards, codes, and regulations:

1. American Society of Mechanical Engineers (ASME):
   a. PTC 10, Performance Test Code on Compressors and Exhausters.

2. American Society of Testing and Materials (ASTM)

3. National Electrical Manufacturer's Association (NEMA) Standards
   a. ICS 4, Terminal Blocks for Industrial Use.
   b. ICS 6, Enclosures for Industrial Controls and Systems.
   c. 250, Enclosures for Electrical Equipment (1000 V Maximum).

4. National Fire Protection Association (NFPA), National Electrical Code (NEC)

5. National Electrical Safety Code (NESC)

6. Occupational Safety and Health Administration (OSHA)

7. Alaska Department of Environmental Conservation (ADEC), Alaska Administrative Code (AAC)

8. Factory Mutual (FM)

9. National Electrical Manufacturers Association (NEMA)

10. Underwriters Laboratories (UL)

1.04 SUBMITTALS

A. Prepare, deliver, and process under provisions of Section 01 30 00. Requests for proposed substitute or “or-equal” equipment/systems/products will be considered in accordance with the provisions of Section 01 25 00.

B. Complete list of all deviations from the Drawings and Specifications.

C. Shop Drawings: Provide the following:

1. CONTRACTOR certification that field measurements have been verified prior to drawing release.

2. Plans, elevations, sections, details, and attachments to other work.
   a. Detail equipment assemblies and indicate dimensions, weights, loads, lifting points, required clearances, method of field assembly, components and location and size of each field connection.
   b. Mechanical and structural components.
   c. Seismic Calculations per latest IBC edition.
   d. Manufacturer and model number of all equipment within this specification and an itemized list of components being furnished.
   e. Layout drawings and equipment cut sheets showing dimensions, clearances, sizes, arrangement, and size of connections, supports, anchors and total weights of the product.
   f. Detailed specifications and data describing the materials of construction and including surface preparation and shop prime and finish coating of the equipment.

3. Motor requirements.

4. Main Circuit Breaker: Catalog information on specific model and accessories provided, including dimensions, terminal provisions, short circuit ratings and electronic trip settings available.

5. Wiring Diagrams: For power, signal and control wiring diagrams, including terminal numbers and wiring labeling.

6. List of components and catalog cuts fully describing all controls and control panel, instrumentation, programmable logic controllers (PLC), operator Interface/machine monitors; instrumentation and control system schematics, tubing, and conduit details, and panel outline drawings.

7. Certification that equipment supplied meets the State of Alaska requirements for third-party listing and labeling per NEC/NFPA.

8. List of instrument settings.

9. Drawings of control panels to include:
   a. Electrical ladder diagram.
   b. Interconnect to all components outside the panel.
   c. Scaled panel face, interior layout, and nameplate layout drawings.
   d. Door layout.
   e. Interior layout.
   f. Sample Operator Interface screens for the LCP.
   g. Panel and subpanel materials of construction.
   h. Panel and subpanel dimensions.
   i. Panel access openings.
   j. Internal wiring and terminal block drawings.
   k. Nameplate text.
   l. Scaled layouts of any graphic panels.

10. Input/output (I/O) list.

11. Operating description for local control panel (LCP).

12. Copy of all programming, setting parameters, alarms, notifications, etc., available for VFD and actual settings implemented on Preliminary and Final basis.

13. One (1) copy each of any PLC and/or Touchscreen/Keypad operator interface terminal (OIT) source code and configuration files used by the system. Electronic files shall be fully documented with editable source code for owner's use/modification. This information to be submitted before equipment functional check and project commissioning.

14. Data
   a. Factory functional and motor performance test reports.
   b. Special shipping, storage and protection and handling instructions.
   c. Manufacturer's instructions for installation.
   d. Manufacturer's equipment installation report.
   e. Location of nearest stocking distributor for spare parts.

f. Recommended spare parts list to maintain the equipment in service for a period of three years. Include a list of special tools required for checking, testing, parts replacement and maintenance with current pricing information.
g. List special tools, materials and supplies furnished with equipment for use prior to and during start-up and for future maintenance.
h. Warranty certificate.

15. Performance Data
    a. Reports of blower performance curves from certified ASME PTC-10 test for each blower specified. Including, but not limited to, certified blower curves showing noise levels in dBa, pressure, capacity, horsepower demand and blower efficiency over the entire operating range of the blower model specified. The Equipment Manufacturer shall also indicate separately the pressure, capacity, horsepower demand and efficiency required at the design point(s).

16. Installation instructions. Submit before blower delivery.
    a. Alignment, adjustment, and repair instructions.
    b. Manufacturer's installation and operation instructions.
    c. Assembly diagrams.
    d. Troubleshooting guide.
    e. Recommended spare parts lists and predicted life of parts subject to wear.
    f. Scheduled maintenance intervals, maintenance requirements, and routine inspections. Include maintenance summary forms.
    g. Detailed description of available Manufacturer's service plans and service agreement programs.
    h. Local sales representative contact information with the company name, contact person, phone number and address.

17. Operation and Maintenance Manuals
    a. Submit before functional checkout and startup per specification Section 01 78 36.

D. Quality Control. Provide the following:

1. General.
    a. Complete Factory Testing Protocol for Witness Testing, test set up schematic for each blower; including data to be collected, expected results and a place to record the actual results at least 60 days prior to the actual witness test date(s).
    b. Blower testing to be witnessed at the factory by the OWNER representative at the OWNERs option.
    c. Test reports shall be submitted after fabrication, but prior to delivery of equipment to jobsite location.
    d. Reports shall be organized and clearly present testing methods and procedures with piping and instrumentation configuration diagram, testing equipment, test data, calculations and analyses, conclusions, and recommendations.
    e. Test reports shall be signed and sealed by the Blower MANUFACTURER's engineer in charge of the testing.
    f. Each certified written test report shall be submitted to the OWNER for review and acceptance. Test reports shall have been reviewed and accepted by the OWNER prior to jobsite delivery.

g. If the certified factory test reports indicate noncompliance with the requirements of the contract documents, the blowers shall be reworked and retested at the Blower Manufacturer's expense until compliance with the specifications is attained.

2. Documentation of third-party listing (e.g., UL, FM, CSA NRTL), as applicable.

3. Certified Factory Test Results:
   a. Certified report of dynamic balancing and maximum vibration amplitude.
   b. Certified Blower AMSE PTC-10 Performance Test or equivalent as approved by the OWNER.

4. Project site functional test and results of performance confirmation checks per specification Section 01 46 50.

5. Manufacturer’s Certificate of Proper Installation and Operation, and Manufacturer’s Certificate of Training
   a. The manufacturer shall provide written certification to CONTRACTOR for submittal to the OWNER that the equipment has been correctly installed and is operating properly.
   b. The manufacturer shall submit to CONTRACTOR for submittal to the OWNER, results of testing performed and required by this specification.
   c. The manufacturer shall provide written certification to CONTRACTOR for submittal to the OWNER that the equipment has been correctly installed and is operating properly.
   d. The manufacturer shall submit to CONTRACTOR for submittal to the OWNER, results of testing performed and required by this specification.
   e. Manufacturer’s Certificate of Training: The manufacturer will provide a list of signatures of operators who have completed the training requirements of this Section.

1.05 WARRANTY

A. Blower MANUFACTURER shall furnish a written warranty in the OWNER’s name to cover the packaged blower systems, including core, motors, VFDs, valves, harmonic filters, transformers, and control components against defects in workmanship and material for a period of two (2) years from final acceptance of the Project.

1.06 MANUFACTURER’S SERVICES

A. A Manufacturer’s Representative for the equipment system specified herein shall be present at the job site for one (1) trip. The visit shall include verifying the Contractor’s installation of the blower equipment is correct and acceptable to the Manufacturer, functional verification and commissioning the blower equipment, and operator training. The trip shall be budgeted for 3 days of onsite service NOT including travel time for installation verification, functional and performance testing, start-up and job-site training. The schedule of the trip shall be coordinated with the OWNER.

B. The Manufacturer’s Representative shall be a direct employee of the Manufacturer or certified by the Manufacturer. The Manufacturer’s Representative shall have over 5 years of field service experience with the equipment furnished under this contract.

C. A Manufacturer's Certificate of Proper Installation and Operation, and Training are required for work under this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 60 00. Specific blower requirements are included below.

B. Protect equipment during shipping, as applicable, from saltwater spray (ocean barge) and freezing, as recommended by the Blower Manufacturer.

C. Ship and store equipment and control components with corrosion-inhibitor systems as recommended by the Blower Manufacturer.

D. Equipment shall be completely factory assembled, enclosure mounted, crated and delivered to protect against damage during shipment.

E. CONTRACTOR is responsible for the coordination of including accelerometers in each shipping container that contains blower equipment. The OWNER reserves the right to reject items that were shipped without accelerometers.

F. Finished surfaces of all exposed flanges shall be protected by wooden blank flanges, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

G. Store equipment in clean, dry, well-ventilated area. Protect equipment, instruments, and control components from freezing and provide heated storage areas as recommended by the Blower Manufacturer and as coordinated with OWNER or the Owner's Representatives.

H. Blower shall not, under any conditions be allowed to sit out-of-doors unprotected. During actual installation of the unit, the blower package shall be covered with a securely anchored waterproof material in the event of any precipitation and also at all times that construction does not require exposure of the equipment.

I. Cover panels and other control elements to protect from dust during construction.

PART 2 PRODUCTS

2.01 GENERAL

A. CONTRACTOR shall be responsible for:

1. Coordination of equipment dimensions, weights and loadings with the listed Manufacturers and the incorporation of the selected equipment into the dimensional constraints of the site or building, within the limits of the structural and architectural concrete and steel, piping and equipment arrangement, and of other features and systems as shown on the Drawings.

2. Modification of appurtenant equipment and piping to accommodate Substitute and "Or-Equal" equipment. CONTRACTOR shall notify OWNER of modifications necessary to

accommodate Substitute and "Or-Equal" equipment and shall submit for review and approval the proposed modifications.

3. Electrical power and automated process control work associated with the installation of wiring of the blowers and appurtenances.

B. The Contract Documents indicate specific required features of the equipment supply and systems, but do not purport to cover all details of design and construction.

2.02 ELECTRICAL

A. Third Party Listings

1. Third party certification, listing and labeling shall be provided per the regulations of the State of Alaska for equipment, systems, assemblies, and panels where standards exist; and for controls and instrumentation; electrical drivers; and appurtenant electrical components. Approved third party certifiers include Underwriters Laboratories (UL), Factory Mutual (FM) and others approved by the State of Alaska. Use listed materials in the work according to the criteria for these listings.

2. All equipment control panels shall be certified by a Nationally Recognized Testing Laboratory (NTRL). The label shall represent compliance with UL 508A requirements for fabricated Industrial Control Panels. All materials used in control panel fabrication shall be listed or recognized according to UL 508 requirements.

B. Code Conformance and Compliance

1. All work will be configured and assembled in accordance with applicable electrical codes observed in the United States and Alaska at the time the equipment is fabricated. Codes that apply include the National Electric Code, the National Electrical Contractor's Association Standards and other codes may apply as appropriate to the Work.

2. System, controls and instrumentation, and electrical drivers. Meet requirements for class, group, and division location in accordance with NFPA 70 and NFPA 820.

3. Manufacturer shall verify equipment to be shipped to job site conforms to NEC/NFPA requirements and meets the State of Alaska third party listing and labeling requirements. Equipment not meeting the requirements of this specification shall be replaced with equipment compliant with this specification, or be certified by an NRRL third party inspector at the Manufacturer's expense.

C. Design/Construction Requirements

1. Provide systems, equipment, and components, including supports and anchorages, in accordance with the provisions of the most current version of the International Building Code (IBC) as amended by the Municipality of Anchorage (MOA).

2. Seismic Restraint, Load and Design: Per the requirements detailed on the Structural drawings.

3. Area Classification: Unclassified. Unless noted otherwise on a Code Analysis Drawing.

2.03 HIGH EFFICIENCY TURBO BLOWERS

A. Tag Numbers: B-104, B-105

B. Manufacturer and model: APG-Neuros, Two (2) NX40S-C080A

C. This equipment is similar to equipment used elsewhere in the OWNER's system. Any design or construction changes resulting from supply of equipment from a different blower manufacturer shall be the sole responsibility of the CONTRACTOR and all costs associated with re-design and/or construction changes shall be borne by the CONTRACTOR.

D. Blowers shall have a double-layer type bump foil air bearing, capable of variable speed operation with a minimum turndown of fifty percent (50%) from its maximum flow capacity and shall use integral variable frequency drives.

1. Each blower shall be capable of operating continuously and satisfactorily at any point between the minimum and maximum flows without any surge, vibration, hunting, or excessive heating of bearings or motor.

2. All elastomeric materials for couplings, valves, etc., shall be rated for a minimum 250° F temperature.

E. Blowers shall meet the following design conditions:

Number of Blowers Installed	Two (2)
Method of Operation	One Blower duty, One Blower redundant. Manual alternation of duty service
Drive Type	Direct
Blower Inlet Flange (inches)	8
Blower Discharge Flange (inches)	6
Design Ambient Barometric Pressure (PSIA)	14.66
Design Site Elevation (FASL)	60
Design Relative Humidity (%)	85
Design Maximum Inlet Air Temperature (ºF)	67
Design Minimum Inlet Air Temperature (ºF)	-11
Design Discharge Pressure (PSIG)	7.5

Design Maximum Flow at Maximum Inlet Air Temperature and Discharge Pressure (SCFM)	868
Design Minimum Flow at Minimum Inlet Air Temperature and Discharge Pressure (SCFM)	354
Maximum Power Consumption (wire to air) at Design Blower Capacity, maximum temperature, and Relative Humidity conditions (kW)	29
VFD-Rated Maximum Motor Horsepower (bhp)	40
Available Power Voltage	480
Available Power Phase	3 phase
Maximum Noise at 3 Feet	80 ± 2 dBa
Allowable vibration level	< 4 mm/sec

1. Blowers will be evaluated based on ASME PTC 10 Type 2 test, the inlet pressure and relative humidity noted above, and the Guaranteed Wire to Air Power in the following table.

Design Points	Number Of Blowers Operating	Blower Airflow Rate	Total System Airflow Rate	Discharge Pressure	Inlet Temperature	Blower Wire to Air Power
		SCFM	SCFM	PSIG	°F	kW
1	1	868	868	7.5	67	29
2	1	354	354	7.5	-11	11

2.04 GENERAL

A. Blowers shall have a double-layer type bump foil air bearing and shall not require oils or lubricants for adequate operation. Bearing shall be manufactured from Inconel alloy and be Teflon coated. Magnetic bearings, single-layer or leaf type air bearings are unacceptable and are cause for immediate rejection.

B. Blowers shall be designed to operate with MANUFACTURER's supplied Local Control Panel(s) to maximize overall system efficiency.

C. Complete blower packages shall be UL and CSA listed and labeled.

D. Blowers shall be factory tested per ASME PTC-10 Type 2 Performance test to verify flow and wire power at design conditions as well as blower maximum conditions. The acceptance criteria are 4% tolerances on flow, 2% Tolerances on Pressure and 1% Tolerance on Power.

E. All elastomeric materials for couplings, valves, etc., shall be rated for a minimum 250° F temperature.

2.05 HIGH SPEED BLOWERS

A. Each blower shall be designed to maintain a minimum rise-to-surge of at least 2.0 psig.

B. Blower impellers shall be a single-stage backswept blade high efficiency configuration designed using Computational Fluid Dynamics (CFD) milled from forged aluminum alloy Type 7075, with first critical speed at least 120 percent of the maximum allowable operating speed. The impeller shall be mounted directly to the motor shaft and shall be dynamically balanced.

C. Bearings shall be sized for a minimum of expected ten (10) years between scheduled overhauls or inspections.

D. Each blower shall be supplied with a sound enclosure covering the entire blower package. The sound enclosure shall be designed for easy inspection and maintenance of all blower package components. Quick release panels shall provide easy and quick access for routine maintenance of the blower and the package components.

E. Blower shall be cooled by forced air convection.

F. Integrated blower instrumentation and PLC programming shall enable measurement and display of shaft vibration, and temperatures in the motor windings and bearings.

G. Each blower shall be supplied with blower core built in vibration isolating mounts. The blower MANUFACTURER shall be responsible for demonstrating the vibration of the blower core below the 4 mm/s design limit.

H. Each blower shall be supplied with a discharge cone that will be designed to reduce discharge flow speeds below 82 feet/sec, to minimize discharge piping noise and losses, and increase overall efficiency.

2.06 APPURTENANCES

A. <u>EACH</u> blower shall be supplied with the following:

1. One (1) integrated electro-pneumatic blow-off valve actuated by blower pressure and an OPEN/CLOSED status signal is available through the blower PLC.
   a. The blow-off valve discharge shall be supplied with a properly sized blow-off silencer for discharge noise levels not to exceed 90 dBa at 5 feet from blower at HMI height.

2. One (1) integrated blower dual filtration shall be comprised of a coarse pre-filter and a fine pleated filter media with 90% by weight per ASHRAE 52-76 with an 98% efficiency @ 10 microns (nom). Filter element shall be removable without disconnecting the intake piping and shall be cleanable by maintenance personnel as a preventative maintenance procedure.

3. Manufacturer’s integrated instrumentation and display on blower HMI.
   a. Inlet differential pressure sensors for filter monitoring

b. Discharge differential pressure sensor
c. Inlet and discharge temperature sensors
d. Bearing temperature sensor
e. Motor temperature sensor
f. Ambient pressure transducer
g. Vibration sensor
h. Indication of OPEN/CLOSED from position switch signal on intake butterfly valves

2.07 MOTORS

A. Each blower shall be supplied with a high speed Permanent Magnet Synchronous Motor (PMSM) operating on 460/480 Volts, 3 Phase, 60 Hertz input power to the VFD. Maximum allowable motor horsepower per design conditions of this specification.

B. The motor shall have a 1.15 service factor.

C. Manufacturer shall provide a phase monitoring device to quickly open the blow off valve to protect the blower against potential surge conditions if there is an incorrect phase sequence, a failure of one of three phases, or an incoming voltage drop below 80% of the nominal value.

2.08 INVERTER/VFD

A. Each blower shall be equipped with a high efficiency UL listed VFD (Variable Frequency Drive) with 97% efficiency at full rated motor speed and power. VFD MANUFACTURER shall be KEB America.

B. Each VFD shall have an operation in the USA for manufacturing, support and provision of replacement parts.

C. Each VFD shall be supplied with a passive harmonic filter that reduces the THD (Total Harmonic Distortion) in compliance with less than 5% THD. The harmonic filters shall have built-in line input reactors and be supplied by Mirus International or MANUFACTURER approved equal. Harmonic filter shall be mounted inside the blower enclosure.

D. Each VFD shall have a sinusoidal filter on its output consisting of an L (inductor) and C (capacitor) filter.

2.09 CONTROLS AND INSTRUMENTATION

A. General

1. All components in the control panel shall be completely factory wired and shall include all necessary controls for both the manual/local and automatic/remote operation as indicated on the Drawings and Specifications.

2. The incoming power provided to the panel shall be 480 volt, 3 phase. A suitable thermal-magnetic main circuit breaker that is 100% rated with RMS-sensing electronic adjustable trip unit, sized to the connected load and including all accessories necessary to make the panel fully functional. Surge protective devices (SPD) shall be provided to protect the

electrical and control components from excessive voltage and current: Type 1 SPD to protect the 480V loads (VFD) and Type 2 SPD to protect the 120V loads (PLC controller box). The SPD locations shall be strategically selected to have surge immunity and the MCOV shall be not less than 115% of nominal voltage.

3. Wiring shall comply with UL/CSA and the Canadian National Electrical Code.

4. All electrical connections to external devices and equipment shall be provided by the CONTRACTOR.

5. Equipment and controls furnished by other MANUFACTURERs shall be provided in accordance with their instructions, where applicable.

6. The blower shall utilize an Allen Bradley CompactLogix PLC with Panelview touch screen display for controls, and input/output (I/O) cards for operation, adjustment and monitoring. If the blower manufacturer does not use a PLC based control system in the blower package, a design change must be implemented to accommodate it. No similar or equal shall be accepted.

B. Miscellaneous electrical devices

1. A 120 VAC to 24 VDC power supply shall be provided to power the programmable controller inputs and other 24 VDC powered devices. The power supply shall be properly sized for the LCP (local control panel) total load.

2. Provide noise filter to provide clean, noise-free power to programmable controllers.

C. Operator Interface: Provide the following indicators on the operator interface:

1. Blower Status (RUN/STOPPED)

2. Operator Mode Selection

3. System pressure display

4. Blower Local / Remote Control

5. Blower Speed Indication Status

6. Blower Run Times (hours)

7. Blower Amp Draw (amps)

8. System Pressure

9. System Flow

10. Intake Butterfly Valves Status (OPEN/CLOSED)

D. Operator interface device

1. The device shall include the following displays:
   a. History: displays history of sequential alarms with date and time of occurrence.
   b. Status: One-touch access to display current system operating status. When the system is running, the display shall show the set point pressure, actual pressure, flow and speed (0-100%).
   c. Alarm Information: Last alarms recorded in memory are displayed with related detailed information on the alarm including time of occurrence, date, and blower's main operating parameters at the time of alarm and how to correct the alarm condition. Each log shall include individual blower run status, VFD mode, flow and alarm type.
   d. Alarm List: One-touch access to an Alarm List of all possible alarms and their current status.
   e. Daily Log/Total: Displays the individual equipment run times and run times since last reset.
   f. Scroll Key: Used to scroll up and down through data.

2. Provide Setup Menu system for adjusting all alarm set points, dead band, delays, etc. Display and adjust flow and pressure set points and time delays. Set equipment alternation to manual or automatic. Restore all factory defaults. Protect adjustable settings with a password.

E. Alarm systems

1. Local indication of alarm conditions shall be provided on the face of the control panel via a general amber alarm light. Specific alarm messages shall be provided on the operator interface screen.

2. All alarm conditions shall be displayed at the local PanelView 700 HMI terminal and shall be available for remote polling/indication via facility SCADA system Ethernet/IP communications link.

F. SCADA System

1. The following outputs shall be provided to the plant PLC and SCADA system via Ethernet/IP communication.
   a. All alarms
   b. All equipment status (On/Off, In Remote/Not in Remote, Off)
   c. All parameters displayed at the operator interface (blower PLC)
   d. Motor speed
   e. Airflow
   f. Discharge pressure
   g. Blower running: output
   h. Blower stopped: output
   i. Blower faulted: output
   j. Remote on: output, enabled when touch screen is placed in remote

2. The following inputs shall be provided from the Plant PLC and SCADA system via Ethernet/IP:
   a. Data communication link for remote control of blower and air flow setpoint adjustment.

3. The following hardwired control shall be implemented at the blower system:
   a. Provide blower run permissive when suction valve is fully open.
   b. Provide local and remote indication of blower suction valve status. Indication of valve status shall be local (via Panelview display) and remote (via Ethernet/IP).

G. System Function

1. Each blower LCP shall consist of a PLC-based control system physically located inside the blower enclosure with the following:
   a. True Programmable Logic Controller:
      1) Allen Bradley CompactLogix 1769-L33ER PLC with Allen-Bradley PanelView Plus 7 Standard version HMI touchscreen.
      2) The PLC shall provide local and remote control, monitoring, and diagnostic capability.
   b. Blower controls shall provide real time monitoring of discharge pressure vs. suction air flow graph indicating current operating point and boundaries.
   c. Each blower shall have the ability to be controlled in four different modes.
      1) Speed (blower functions independently on speed control)
      2) Pressure
      3) Flow
      4) Dissolved Oxygen
   d. The blower PLC shall have a minimum of 4 operating methods.
      1) Local control
      2) TCP/IP control
      3) Remote Terminal Block control
      4) Remote Terminal Block start/stop & Touch screen mode
   e. Each blower PLC shall allow the blower to automatically restart, when operating in Terminal Block Mode or remote TCP/IP control in the event of a power failure. The blower PLC shall automatically reset all faults and alarms in the PLC and restart the blower.
   f. Each blower LCP shall perform dynamic speed changes when the blower operating point approaches the surge boundary. The PLC automatically increases the speed of the blower such that surge is avoided and the blower BOV is not engaged.
   g. Each blower LCP shall automatically perform dynamic adjustments to the blower operating range during seasonal ambient temperature variations such that attainable maximum and minimum flow is always optimized. Dynamic adjustments shall not expose the blower to surge.
   h. Blower PLC controls shall include intuitive, user friendly fault menus for ease of monitoring diagnostics and troubleshooting.
   i. Each blower shall include built in automatic surge protection.
   j. Blower controls shall include built in measurement or calculation for the following parameters:
      1) Flow (calculated)
      2) Speed (calculated)
      3) Vibration
      4) Temperature (inlet and discharge air, motor, bearing)
      5) Pressure

k. The blower PLC shall be accessible through a touch screen control panel and shall control the blow-off valve for each blower.
l. All integrated controls shall be enclosed in a sub-panel located inside the blower enclosure.
m. Turbo Blower PLC shall be capable for communication through Ethernet/IP communication protocol.

2.10 SHOP PAINTING

A. The blower enclosure shall be painted in MANUFACTURER's standard color. Painted carbon steel enclosures shall be Zinc primed and dual powder coated with a total dry film thickness of 4 mils dft.

2.11 FACTORY ACCEPTANCE TESTS

A. All equipment shall be factory tested in accordance with submitted Test Procedure approved by the OWNER.

B. All factory testing shall be witnessed by the OWNER.

C. Tests shall be performed on the actual assembled unit being supplied for this project. Prototype model tests and calculated values based on previous model testing will not be acceptable.

1. Functional Package Test: Blower(s) shall be given a factory mechanical test to assure mechanical integrity. If the test indicates that adjustments are necessary to ensure conformance with specifications, such adjustments shall be made prior to shipment. Unless otherwise specified, a certified report of a mechanical test of each blower furnished shall be provided. The mechanical test shall consist of operating the units at or near design conditions for a minimum of one (1) hour. Test data shall include duration of the test, bearing temperatures, speed, brake horsepower, pressure and temperature rise and vibration level.

2. Performance Test: A certified report of a performance test of the blowers furnished shall be submitted to the OWNER for review. The performance test shall be in accordance with ASME PTC 10 (TYPE 2) Power Test Code for Displacement Compressors, Vacuum Pumps and Blowers and shall demonstrate the durability with the applicable performance criteria specified.

D. In the event the blower fails to meet the performance requirements specified, the OWNER shall have the right to require the MANUFACTURER to modify or replace the blower to meet the performance requirements specified.

E. Any subsequent tests as may be necessary to ensure compliance with these Specifications shall be performed at no additional cost to the OWNER.

F. Performance tests shall cover a minimum of two design points of this specification.

G. MANUFACTURER/CONTRACTOR shall notify OWNER at least 30 days prior to conducting the factory acceptance tests. CONTRACTOR and OWNER shall confirm their decision and/or

acceptance of the proposed date within five (5) days of receipt of the MANUFACTURER's notification.

H. MANUFACTURER shall complete production and acceptance testing of the product on a schedule pre-agreed to with the CONTRACTOR and OWNER. Should there be a delay of more than fifteen (15) days for the CONTRACTOR and/or OWNER to take delivery, the MANUFACTURER shall invoice the amount allocated for delivery on the order and store the product on their premises until delivery is approved.

2.12 SPARE PARTS AND SPECIAL TOOLS

A. Manufacturer shall furnish the following recommended spare parts.

1. Three (3) Sets of inlet air filters per blower

B. Furnish one set of special tools required for complete assembly or disassembly of blower system components, together with a storage box (or boxes) for the same. This tool kit shall be sufficiently complete to permit normal repair and maintenance of all equipment furnished under this project.

PART 3 EXECUTION

3.01 GENERAL

A. Install and adjust equipment in accordance with the Drawings, approved shop drawings and the MANUFACTURER's instructions. Do not operate the equipment until the installation is approved by the MANUFACTURER's representative.

3.02 ASSEMBLY AND INSTALLATION

A. Install and adjust equipment in accordance with the Drawings, approved shop drawings and the MANUFACTURER's instructions. Do not operate the equipment until the installation is approved by the MANUFACTURER's representative.

B. Do not drill, cut or weld any component to the blower enclosure or accessories. Only bolted connections will be allowed in the field.

C. MANUFACTURER to certify installation readiness prior to start-up for conformance to MANUFACTURER's instructions.

D. Install free-standing panels on concrete housekeeping pads as detailed on the Drawings.

E. Anchor wall mount panels rigidly into wall system with approved anchoring devices.

3.03 FIELD TESTS

A. Upon finding of satisfactory installation, and prior to startup and testing, the Manufacturer shall issue a Certificate of Proper Installation and provide a copy to the OWNER. Startup and testing may begin once the OWNER has received the Certificate of Proper Installation from the Manufacturer.

B. The blowers shall be subjected to a field running test under actual operating conditions. Tests shall include performance, noise testing, and vibration testing as approved by the OWNER. The field tests shall be made by the OWNER/CONTRACTOR in the presence of and as directed by the Manufacturer's Representative. The field tests shall demonstrate that under all conditions of operation the unit:

1. Has not been damaged by transportation or installation.

2. Has been properly installed.

3. Has no mechanical defect.

4. Is in proper alignment.

5. Has been properly connected.

6. Is free of overheating of any parts.

7. The as installed equipment meets the maximum vibration limits specified.

8. The as installed units do not exceed the maximum noise levels submitted in the BID.

9. Is free of overloading of any parts.

10. Shall operate correctly and as specified with the control system.

C. The blowers shall be tested to confirm air flow, delivery pressure and power draw performance meets design conditions of this specification.

1. Before readings are taken, the blower shall be run long enough to ensure that steady state conditions are achieved.

2. CONTRACTOR to provide a calibrated RMS Power Meter instrument for external measurement of power draw (Amps, kW, kVA) during performance testing. Pressure, temperature, relative humidity, and flow instrumentation onboard the blower that have been performance verified at the factory may be used to confirm blower performance during commissioning. The fluctuations of the air flow and pressure readings shall be controlled within 2%.

3. Input power to be measured directly at the input to the Main Circuit Breaker for the blower package.

4. All corrections to standard conditions due to alternate ambient conditions are to be performed per ASME PTC-10 Performance Test or equivalent as approved by the OWNER.

5. The blower test shall be accepted if the specified power withdrawn is within 5% of the design conditions of this specification. In the event the power draw is in excess of 5% of the design condition, the blowers shall be re-worked and re-tested at no additional cost to the OWNER.

D. Any defects in the equipment or failure to meet the requirements of the Specifications shall be promptly corrected by the Manufacturer.

E. After the equipment completes the performance test, SCADA system integration and commissioning shall commence by the OWNER's SCADA System Integrator. Refer to Section 01 14 00 for SCADA system schedule allowance. At the end of the SCADA integration, the equipment shall undergo a 7-day functionality test in auto-remote mode. The equipment shall function properly in actual service for seven days. Should the blower shut down or significant interruptions occur during the 7-day test, the test shall be re-started from the beginning at no additional cost to the OWNER.

F. Significant interruptions shall include failure of any critical equipment unit, system, or subsystem that is not satisfactorily corrected within 4 hours after failure

3.04 MANUFACTURER'S SERVICES

A. CONTRACTOR shall hold a Pre-Start-Up meeting with the MANUFACTURER to verify proper blower installation, Start-Up procedure and operating conditions. CONTRACTOR shall provide a firm date for the required services with a minimum of four (4) weeks advanced notice.

B. A Manufacturer's trained startup technician, experienced in the installation of the systems specified, and with at least five (5) years of field experience shall be present at the job site and / or classroom designated by the OWNER / CONTRACTOR for the number of days specified to provide the following services:

1. Installation Inspection: Prior to system start up, the Manufacturer's startup technician shall inspect the installation of the equipment including instrumentation, and control and power wiring to verify system installation is satisfactory for operation and make any adjustments, necessary to test, and place the equipment in operating condition.

2. Startup and Performance Testing Services: The blower equipment Manufacturer startup technician will provide performance testing, adjust the equipment, and troubleshoot problems with the equipment as needed. Work scop to include:
   a. Start up for each blower. Startup to include running each blower individually for at least 4 hours under actual operating conditions prior to initiating performance testing for each during which onsite conditions and operational data are to be collected and recorded.
   b. Evaluate harmonic distortion. During initial 4 hours of blower operation, Manufacturer's startup technician to confirm the total harmonic distortion does not exceed the recommended limits.
   c. Data collection. Collected data to be shared with Owner's representative for use in evaluating compliance with specified performance conditions.
   d. Performance evaluation. If performance of either blower does not meet specified conditions for air delivery rate, delivery pressure, and/or power draw, Manufacturer's startup technician to work with Contractor to execute corrective action and repeat the performance testing effort.

3. Operator Training: The Equipment Supplier shall provide a minimum of four (4) hours of training at the project site to review the Operations and Maintenance (O&M) Manuals for

the project with the operations personnel. Training scheduling may occur as best facilitates the instruction.

a. O&M Manuals used for the training must have prior approval by the OWNER through the submittal process prior to use in the training.
b. Equipment Supplier to provide OWNER signatures of operators attending the training certifying they have completed the training provided for the project.
c. Training details to be submitted three (3) weeks prior to scheduled training. CONTRACTOR shall coordinate with the operators and OWNER to attend the training.

3.05 RECORD DRAWINGS

A. CONTRACTOR shall maintain a current set of construction drawings and specifications that reflect any changes, modifications, clarifications, additions, or deletions from the work as shown in the original construction drawings. Annotations shall include any CONTRACTOR issued equipment or wiring identification tags and/or numbers. Record drawing information shall be provided to the OWNER at the completion of system start up and substantial completion.

3.06 TROUBLESHOOTING SERVICES

A. If equipment and system do not meet manufacturer's published performance ratings or the requirements of this specification, CONTRACTOR and Manufacturer's Representative shall provide troubleshooting services to identify the cause of the problem.

B. If performance problems are due to defects in the work installed by CONTRACTOR, CONTRACTOR shall correct the defective work at no cost to the OWNER.

C. If equipment does not meet the manufacturer's performance criteria due to material or workmanship defects in the equipment, CONTRACTOR shall, with the assistance of the Manufacturer's Representative for that equipment, identify the fault and recommend repair and/or replacement of the faulty component or components to the OWNER.

3.07 FIELD FINISHING AND TOUCHUP

A. Provide field finishing and equipment touchup as recommended by the Manufacturer.

3.08 FINAL CLEAN

A. Clean surfaces in accordance with Manufacturer's written instructions.

END OF SECTION

SECTION 43 15 13
BLOWER INTAKE AND AIR FILTER

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnish, install, test, and verify the function of one (1) combination air intake filter system and accessories serving both blowers, as specified herein, in coordination with related specification Sections, and as shown on the Drawings.

B. Air intake filter system head losses shall be included by the Blower MANUFACTURER in their submitted blower performance calculations.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 QUALITY ASSURANCE/REFERENCES

A. As applicable, meet the requirements of the most recent version of the following standards, regulations, and requirements as may be referenced in this Section and the Contract Documents.

1.04 SUBMITTALS

A. Prepare, deliver, and process under provisions of Section 01 30 00. Requests for proposed substitute or “or-equal” equipment/systems/products will be considered in accordance with the provisions of Section 01 25 00.

B. Complete list of all deviations from the Drawings and Specifications.

C. Shop Drawings. Provide the following:

1. Detailed drawing.

2. Product Data:
   a. Detailed listing of materials and materials of construction
   b. Product literature and catalog cut sheets

3. Installation Instructions
   a. Installation requirements and guidelines for all proposed equipment shall be provided and approved prior to shipment.

D. Installation, and Operation and Maintenance Manuals.

1. Submit before functional checkout and startup per specification Section 01 78 36.

E. Quality Control. Provide the following:

1. Project site functional test and results of performance confirmation checks per specification Section 01 46 50.

1.05 DELIVERY, STORAGE AND HANDLING

A. See Section 01 60 00.

PART 2 PRODUCTS

2.01 INTAKE AND AIR FILTER

A. Rated: 1100 SCFM at 0.1-inch water gauge (WG) maximum initial; Not to Exceed 12-inch WG

B. Housing: Powder Coated Carbon Steel.

C. Process Connection: 8-inch Class 125/150 ANSI flange (12½-inch outside diameter (OD) with eight (8) 7/8-inch diameter holes, and 11¾-inch bolt circle diameter (BCD)).

D. Freeze Discouragement. 316L stainless steel discharge-air knife permanently attached to housing, with ¾-inch NPT connection for LPA.

E. Air Filter Element: Hi-flow synthetic medium, 98% efficient at 10-micron (nominal). No tools shall be required to change the filter element.

F. Manufacturer and Model: Endustra Filter Manufacturing, Tri-Vent Series DK, Model TM09RJ-DK-E047937. Or approved equal.

2.02 SPARE PARTS

A. Manufacturer shall furnish the following recommended spare parts.

1. Three (3) additional air filter elements

PART 3 EXECUTION

3.01 STORAGE AND HANDLING

A. See Section 01 60 00.

3.02 INSTALLATION

A. Install and test in accordance with the Manufacturer’s procedures approved through shop drawing submittals, and as shown on the Drawings.

END OF SECTION

SECTION 46 51 21
COARSE BUBBLE DIFFUSER

PART 1 GENERAL

1.01 WORK INCLUDED

A. Remove existing coarse bubble diffusers, and furnish, install, test, and verify the function of new Coarse Bubble Diffusers and accessories as specified herein, in coordination with related specification Sections, and as shown on the Drawings.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including Special Provisions, Division 01 – General Requirements, Technical Specifications, Municipality of Anchorage Standard Specifications (MASS), and the AWWU Design and Construction Practices Manual (DCPM) apply to this Section.

1.03 QUALITY ASSURANCE/REFERENCES

A. As applicable, meet the requirements of the most recent version of the following standards, regulations, and requirements as may be referenced in this Section and the Contract Documents.

B. American Society of Civil Engineers (ASCE). ASCE 2 - Measurement of Oxygen Transfer in Clean Water

1.04 SUBMITTALS

A. Prepare, deliver, and process under provisions of Section 01 30 00. Requests for proposed substitute or “or-equal” equipment/systems/products will be considered in accordance with the provisions of Section 01 25 00.

B. Complete list of all deviations from the Drawings and Specifications.

C. Shop Drawings. Provide the following:

1. Detailed layout drawings for in-basin aeration components including:
   a. Layout and configuration of aeration system
   b. Detail drawings of diffuser assemblies showing components, method of construction, and attachment mechanism to air header distribution piping
   c. Detail drawings of all piping connections including drop to manifold, manifold to header and inline connections for manifold and headers
   d. Detail drawings of pipe support components

2. Product Data:
   a. Detailed listing of materials and materials of construction
   b. Product literature and catalog cut sheets

3. Installation Instructions
   a. Installation requirements and guidelines for all proposed equipment shall be provided and approved prior to shipment.

b. Information on the aeration system, as applicable, shall include but not be limited to:
   1) Diffuser unit assembly.
   2) Diffuser assembly attachment.
   3) Piping components and assembly
   4) Piping support components

D. Quality Control. Provide the following:

1. Project site functional test and results of performance confirmation checks per specification Section 01 46 50.

2. Installation, and Operation and Maintenance Manual.
   a. Information on the aeration system shall include but not be limited to:
      1) Air flow balancing
      2) Diffuser assembly maintenance and cap replacement
      3) Operational troubleshooting guidelines

1.05 DELIVERY, STORAGE AND HANDLING

A. See Section 01 60 00.

PART 2 PRODUCTS

2.01 COARSE BUBBLE DIFFUSERS

A. Number of Diffusers: 80

B. Each diffuser shall:

1. Have an integral, circular rubber snap-on diaphragm which shall be located directly above the molded base. During aeration the diaphragm shall distend, allowing the air to exit through orifices in the diaphragms. When air stops, the diaphragm shall instantly seal against the base, preventing backflow and clogging. The air flowing through the orifices shall increase the local turbulence and increase the oxygen transfer.

2. Consist of two (2) simple parts securely attached to each other to form one (1) structurally sound unit. The base shall be of molded Celcon and the diaphragm shall be molded EPDM-based thermoplastic rubber.

3. Have a self-balancing feature built into the rubber diaphragm to provide for proper headless at flows ranging from 1 to 13.63 cfm without the need to change diaphragms or orifices. Each diffuser shall be equipped with ¾-inch tapered pipe threads for direct mounting without the use of additional mounting brackets or clamps.

4. Be capable of discharging 5.44 cfm of air at a differential pressure across the unit not to exceed 13-inches of water when operating under a static head of 15-feet of water.

C. Manufacturer and Model: Evoqua Water Technologies, Snap-Cap™ Diffuser, Model 750-T-10.

PART 3 EXECUTION

3.01 STORAGE AND HANDLING

A. See Section 01 60 00.

3.02 INSTALLATION

A. Install coarse bubble diffusers in accordance with the approved procedures submitted with the shop drawings and as shown on the Drawings, unless otherwise approved.

3.03 PRESSURE/LEAKAGE TESTING

A. Perform pressure/leakage testing similar to piping system pressure testing. See Section 40 05 01.

3.04 TESTS AND INSPECTION

A. Test to eliminate all air leaks, product and installation deficiencies

B. Adjust and balance air pressure and air flow

END OF SECTION

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION IV

SUBMITTAL LIST AND STANDARD FORMS

Submittal List

Submittal Transmittal

Certificate of Compliance

Design Clarification & Verification Request

Deviation Request

Substitution Request

Subcontractor & Supplier List

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

Submittal List

Job #: WM.00087 (WTR) Contractor: _____

Submittal No.	Description	Submittal Schedule
10.03.2	Bid Submittals	Prior to the time of opening specified in the Invitation to Bid and the exact date and time of receipt of Bids shall be recorded.
10.04.9	Waste disposal on private property	Prior to construction.
10.04.13	Traffic Control Plan (TCP)	Within ten (10) days of NTP, or five (5) days before commencement of work, whichever is earlier.
10.04.15 20.02.4.A	Storm Water Pollution Prevention Plan (SWPPP)	No less than ten (10) business days before commencing any excavation work.
10.04.19	Record Documents	Within thirty (30) days after Substantial Completion or prior to Final Acceptance of the project, whichever is earlier.
10.05.3	Construction Progress Schedule	Within ten (10) days of the effective Notice to Proceed, and prior to the commencement of Work.
10.05.3	Critical Path Method (CPM) Schedule	No later than twenty-one (21) days from the effective date of the Notice to Proceed and at least monthly thereafter.
10.05.4	Unusual Working Hours	At least forty-eight (48) hours advance notice.

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

10.05.5	Shop Drawings	Within reason and in such sequence as to cause no delay in the Work or in the work of the Owner or any other contractor.
10.05.6	Product Data	Within reason and in such sequence as to cause no delay in the Work or in the work of the Owner or any other contractor.
10.05.7	Materials Substitutions	Within ten (10) calendar days of the effective date of the Notice-to-Proceed (or such time as may be approved in writing by the Engineer.)
10.05.10	Subcontractor List	Within ten (10) days after the effective date of the Notice-To-Proceed, and prior to the commencement of the Work.
10.05.18	Changed Conditions	No later than two (2) working days, and before such conditions are disturbed.
10.05.20	Change Order Proposal	Prior to payment of changed Work
10.05.21	Claims for Additional Compensation	Initial Notification - Immediately.
10.05.26	Pre-Final Inspection Notification	After completion of Work After code compliance inspections
10.05.29	Termination of Work for Owners Convenience	Immediately after receiving a Notice of Termination.
10.06.8	24-Hour Emergency Contact Number*	Prior to commencement of work *Found in Construction Specifications
10.05.34	Work Plan	Prior to beginning construction.
10.06.9	Insurance	Prior to execution of the Contract.
10.07.4	Change Order Proposal/ Negotiated Changes	Prior to payment of the changed Work.

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

10.07.5	Application for Partial Payment	
10.07.7	Final Payment	Upon completion of the Work and issuance of a certificate of completion by the Engineer, and prior to acceptance of the work.
20.02.4.B	Hazardous Material Control Plan (HMCP), Spill Prevention, Control, and Countermeasure Plan (SPCC)	No less than ten (10) business days prior to the beginning of the work.
20.30.3	Excavation, Shoring, and Temporary Material Storage Plan	
30.01.7	Ready-Mixed Concrete	Prior to unloading the concrete mix at the construction site.
40.06.2.A	Asphalt Concrete Pavement	Prior to paving.
60.02.4.A	Written Notice of mainline flow interruptions.	Minimum of seventy-two (72) hour and a maximum of one-hundred forty-four (144) hours in advance of interruption.
60.02.5	Flushing and Testing Schedule and Procedure	Forty-eight (48) hours prior to flushing, testing.
60.07.2	Temporary Water Systems Plan	Within a reasonable time and in such sequence as to not cause a delay in the Work
65.02.14	As-built Surveys and Record Drawings	Upon completion of construction activity.
75.04.2	Seed Certification	Ten (10) days prior to application.

NOTE: The above list of submittals is not all-inclusive. In addition to the above, the Contractor is required to comply with all submittal requirements as required or identified in the plans, Special Provisions, MASS, or as directed by the Engineer. (See Division 10, Section 10.04, Article 4.3.)

SUBMITTAL TRANSMITTAL

PROJECT: _____ SUBMITTAL NO.: _____

CONTRACTOR: _____ CONTRACT NO.: _____

ORIGINATOR: _____ SPEC. SECTION: _____

DATE SUBMITTED: _____ DRAWING NO.: _____ SHEET _____ OF _____

TO: ANCHORAGE WATER & WASTEWATER UTILITY
Engineering Division
3000 Arctic Boulevard

ATTN: _____

ITEM: _____

SUPPLIER/CONTRACTOR:

☐ Original Submittal ☐ 3rd

☐ 2nd ☐ 4th

		REVIEW ACTION						
ID. NO.	DETAILED DESCRIPTION (Provide Itemized List of Contents of this Submittal)	COPIES SENT	NO EXCEPTION TAKEN A	MAKE CORRECTIONS AS NOTED B	AMEND AND RESUBMIT C	REJECTED RESUBMIT D	COPIES RETURNED	NOTES ATTACHED

Complete either (a) or (b), following:

☐ (a) We have verified that the material or equipment contained in this submittal meets all the requirements specified or shown (no exceptions).

☐ (b) We have verified that the material or equipment contained in this submittal meets all the requirements specified or shown, except for the following deviations (list deviations, attach a separate sheet if necessary).

Corrections or comments made relative to submittals during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications. This submittal is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades, and performing his work in a safe and satisfactory manner.

CONTRACTOR: _____ ENGINEER: _____
(Signature) (Signature)

ROUTING	RECEIVED BY NAME / COMPANY	DATE RECEIVED	DATE FORWARDED	COMMENTS
Project Manager				
Designer				
Project Manager				
Contractor				

AWWU SUBMITTAL REVIEW ACTION

PROJECT _____ SUBMITTAL NO. _____

CONTRACTOR _____ CONTRACT NO. _____

ORIGINATOR _____ SPEC. SECTION _____

DATE SUBMITTED _____ DRAWING NO. _____ SHEET _____ OF _____

A-NO EXCEPTION TAKEN
B-MAKE CORRECTIONS AS NOTED
C-AMEND AND RESUBMIT
D-REJECTED RESUBMIT

REVIEW ACTION	ID. NO.	COMMENT:

ENGINEER: _____ DATE: _____

CERTIFICATE OF COMPLIANCE

Project Name: _____ Contract No. C-_____

I (WE) CERTIFY THAT ALL WORK HAS BEEN PERFORMED AND MATERIALS SUPPLIED IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS FOR THE ABOVE WORK, AND THAT:

A. Not less that the prevailing rates of wages as ascertained by the governing body of the contracting agency has been paid to laborers, workmen, and mechanics employed on this work;

B. There have been no unauthorized substitutions of subcontractors; nor have any subcontracts been entered into without the names of the subcontractors having been submitted to the Engineer prior to the start of such subcontracted work;

C. No subcontract was assigned or transferred or performed by any subcontractor other than the original subcontractor, without prior notice having been submitted to the Engineer together with the names of all subcontractors;

D. All claims for material and labor and other services performed in connection with these specifications have been paid;

E. All monies due the State Industrial Accident Fund, the State Unemployment Compensation Trust Fund, the State Tax Commission, hospital associations and/or other have been paid.

_____
(Company Name)

_____ _____
(Contractor's Signature) (Date)

STATE OF ALASKA)
)ss.
THIRD JUDICIAL DISTRICT)

The foregoing instrument was acknowledged before me this _____ day of _____, 20 ___, by _____ to be the _____ of the company.

_____
Notary Public
My commission expires: _____

DESIGN CLARIFICATION/VERIFICATION REQUEST (DC/VR)

PROJECT _____ **DC/VR NO.** _____

CONTRACTOR _____ **CONTRACT NO.** _____

ORIGINATOR _____ **SPEC. SECTION** _____

DATE SUBMITTED _____ **DRAWING NO.** _____ **SHEET** _____ **OF** _____

DESCRIPTION OF DC/VR

RESPONSE REQUESTED BY (Date) _____

RESPONSE TO DC/VR

RESPONSE BY (Name/Company) _____

ROUTING	RECEIVED BY NAME / COMPANY	DATE RECEIVED	DATE FORWARDED	COMMENTS
Project Manager				
Designer				
Project Manager				
Contractor				

DIRECTION

☐ **Proceed per Engineers Response. No change in contract price or time is recognized.**

☐ **Do not proceed until** _____

☐ _____

DEVIATION REQUEST (DR)

PROJECT _____ **DR NO.** _____

CONTRACTOR _____ **CONTRACT NO.** _____

ORIGINATOR _____ **SPEC. SECTION** _____

DATE SUBMITTED _____ **DRAWING NO.** _____ **SHEET** _____ **OF** _____

DESCRIPTION OF DR

A. Original Contract Requirements:

B. Reason for Deviation Request:

C. Proposed Deviation:

D. Any Changes in Contract Time or Cost ☐ **YES** ☐ **NO**

CONTRACTOR SIGNATURE -
Date_____

RESPONSE
REQUIRED BY (Date)_____

RESPONSE TO DR

RESPONSE BY (Name/Company)_____

ROUTING	RECEIVED BY NAME / COMPANY	DATE RECEIVED	DATE FORWARDED	COMMENTS
Project Manager				
Designer				
Project Manager				
Contractor				

DIRECTION

☐ **Approved**

☐ **Approved as Noted** **BY** _____
(Signature)

☐ **Disapproved**

SUBSTITUTION REQUEST (SR)

PROJECT _____ **SR NO.** _____

CONTRACTOR _____ **CONTRACT NO.** _____

ORIGINATOR _____ **SPEC. SECTION** _____

DATE SUBMITTED _____ **DRAWING NO.** _____ **SHEET** _____ **OF** _____

SPECIFIED ITEM:

SECTION	PAGE	PARAGRAPH	DESCRIPTION

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs and performance and test adequate for evaluation of the request. Applicable portions of the data are clearly identified.

The undersigned states that the following paragraphs, unless modified on attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings and will not require any change in any of the Contract Documents.
2. The undersigned will pay for changes to the design, including engineering design, detailing, and construction costs caused by the requested substitution which is estimated to be $_____.
3. The proposed substitution will have no adverse affect on other contractors, the construction schedule (specifically the date of substantial completion), or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. The incorporation or use of the substitution in connection with the work is not subject to payment of any license fee or royalty.

The undersigned further states that the function, appearance, and quality of the Proposed Substitution are equivalent or superior to the Specified Item.

Submitted by CONTRACTOR	**Reviewed by ENGINEER**
Signature: _____	☐ **Accepted**
Firm: _____	☐ **Accepted as Noted**
_____	☐ **Not Accepted**
Date: _____	☐ **Received too Late**
Telephone: _____	
	By: _____
Attachments:	**Title:** _____
_____	**Date:** _____
_____	**Remarks:** _____

REV 12/1999

ANCHORAGE WATER AND WASTEWATER UTILITY

Subcontractor/Supplier List

Project Name:

Project Number:

List all suppliers, subcontractors, their mailing addresses and a summary of the extent and character of the work to be performed by each:

Supplier/Subcontractor	Address	Extent/Character of Work

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION V

CONTRACT AND BID DOCUMENTS

Contract

Bid Bond

Performance & Payment Bond

Certificate of Insurance

Bidder's Checklist

Responsible Bidder Questionnaire

C O N T R A C T

Invitation to Bid No. **2022C_____**

Contract No. **C-2022_____**

NAME AND ADDRESS OF CONTRACTOR:

_____

_____

_____

Check appropriate box:

☒ **Incorporated in the State of**

MUNICIPALITY OF ANCHORAGE, acting through _____ (hereinafter the Owner).

Contract for _____

BID SCHEDULES	**ITEMS**	**PLAN SHEET FILE NUMBERS**	**AMOUNT**
			$ _____

Total Amount : $ _____

THIS CONTRACT, entered into by the MUNICIPALITY OF ANCHORAGE, ALASKA, acting through the Owner named above, and the individual, partnership, or corporation named above, hereinafter called the Contractor, WITNESSETH that the parties hereto do mutually agree as follows:

Statement of Work: The Contractor shall furnish all labor, equipment and materials and perform the Work above described, for the amount stated, in strict accordance with the Contract Documents.

CONTRACT DOCUMENTS

I. This CONTRACT consisting of 4 pages.

II. The Bid Proposal Section ___ consisting of ____ pages numbered as ____, **as contained in ITB 2022C_____.**

III. The Contract Performance and Payment Bond **_____.**

IV. The Contractor's Certificate of Insurance Dated **_____.**

V. Municipality of Anchorage Standard Specifications dated 2015 (MASS) Incorporated by Reference, **as contained in ITB 2022C_____.**

VI. Specifications consisting of the following:

Supplemental Provisions Section _____ consisting of _____ pages, with attachments Exhibit A through F, **as contained in ITB 2022C_____.**

VII. Equal Opportunity Special Provisions and Forms Section _____ consisting of _____ pages, **as contained in ITB 2022C_____.**

VIII. Disadvantaged/Women-Owned Business Enterprise (DBE/WBE) Specification Section _____ consisting of _____ pages, **as contained in ITB 2022C_____.**

IX. The Laborers' and Mechanics' Minimum Rates of Pay dated September 1, 2015 Section _____ consisting of _____ pages, **as contained in ITB 2022C_____.**

X. Submittal List Section _____ consisting of _____ page, **as contained in ITB 2022C_____.**

XI. The Drawings consisting of _____ sheets numbered _____, **as contained in ITB 2022C_____.**

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the Contract Date entered below.

MUNICIPALITY OF ANCHORAGE, ALASKA

BY _____
Signature

Purchasing Officer or designee
Title

_____
Date of Signature and Contract Date:

VENDOR _____

BY _____
Signature

_____
Printed Name

_____
Title

_____
Date of Signature

CONTRACT AND PERFORMANCE AND PAYMENT BOND SIGNATURE INSTRUCTIONS

1. The full name and business of the Contractor shall be inserted on Page 1 of the Contract and on the Performance and Payment Bond, hereinafter the Bond.
2. Two copies of the Contract and the Bond shall be manually signed by the Contractor. If the Contractor is a partnership or joint venture, all partners or joint ventures shall sign the Contract and the Bond except that one partner or one joint venturer may sign for the partnership or joint venture when all other partners or joint venturers have executed a Power-of-Attorney authorizing one partner or joint venturer to sign. The Power-of-Attorney shall accompany the executed contract and the Bond.
3. If the Contractor is a corporation, the President of the corporation shall execute the Contract and the Bond unless a Power-of-Attorney or corporate resolution shall accompany the executed Contract and Bond.
4. The Bond shall be returned to the Purchasing Division undated. The Contract Date shall be inserted on the Contract when the Municipality signs the Contract and the Bond shall be dated the same as the Contract Date.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we, _____ as Principal, and _____ a corporation organized under the laws of the _____ and authorized to transact surety business in the State of Alaska, of _____ _____ as Surety, are held and firmly bound unto the MUNICIPALITY OF ANCHORAGE, as Obligee, in the full and just sum of _____ _____ ($_____) Dollars, lawful money of the UNITED STATES, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by the presents.

WHEREAS, the said Principle is herewith submitting its proposal for _____ _____.

The condition of this obligation is such that if the aforesaid Principal will, within the time required enter into a formal contract and give a good and sufficient bond to secure the performance of the terms and conditions of the contract, then this Obligation to be void; otherwise the Principal and Surety will pay unto to the Obligee the amount stated above.

Signed, sealed, and delivered _____, 20_____.

WITNESS AS TO PRINCIPAL:

_____ _____
Contractor Name

_____
Contractor Signature

_____
(AFFIX CORPORATE SEAL) Corporate Surety

_____

_____
Surety Business Address

BY: _____
(Attorney-In-Fact)

(AFFIX SURETY SEAL)

CONTRACT PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, That we _____

_____ of _____

as Principal, and _____

a corporation organized under the laws of the _____

_____ and authorized to transact surety business in the State of Alaska,

of _____

as Surety, are held and firmly bound unto the MUNICIPALITY OF ANCHORAGE, as Obligee, in the full and just sum of _____

($ _____) Dollars, lawful money of the UNITED STATES, for the payment which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION IS SUCH, that whereas the principal has entered into a certain contract dated the _____ date of _____ 20 _____, with the Obligee for the construction of _____

_____

which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract, and shall promptly make payments to all persons supplying labor and material in the prosecution of the work provided for in said contract, during the original term of said contract and any extensions of modifications thereof that may be granted by the Municipality, with or without notice to the Surety, then this obligation to be void; otherwise to remain in full force and effect.

This obligation is made for the use of said Obligee and also for use and benefit of all persons who may perform any work or labor or furnish any material in the execution of said Contract and may be sued on thereby in the name of said Obligee.

This said Surety, for the 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 anywise affect its obligations 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.

Whenever Principal shall be, and declared by Obligee to be in default under the Contract the Obligee having performed Obligee's obligations thereunder, the Surety may promptly remedy the default or shall promptly:

1. Complete the Contract in accordance with its terms and conditions, or
2. Obtain a bid or bids for submission to Obligee for completing the Contract in accordance with its terms and conditions and upon determination by Surety of the lowest responsible bidder, or, if the Obligee elects, upon determination by Obligee and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Obligee and make available as Work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price but not exceeding, including other costs and damages for which the Surety may be liable hereunder the amount set forth in the first paragraph hereof. The term "balance of the contract price" as used in this paragraph, shall mean the total amount payable by Obligee to Principal under the Contract and any amendments thereto, less the amount properly paid by Obligee to Principal.

IN TESTIMONY WHEREOF, the parties hereunto have caused the execution hereof in _____ _____ original counterparts as of the _____ day of _____, 20_____.

WITNESS AS TO PRINCIPAL:

_____ _____

Principal Name

_____

Principal Signature

(AFFIX CORPORATE SEAL) _____

Corporate Surety

_____

_____

Surety Business Address

(AFFIX SURETY SEAL) BY: _____

(Attorney-In-Fact)

INSURANCE

By submitting a bid, the bidder agrees, if they are the successful bidder, to obtain and maintain the insurance required by this section. The bidder also agrees to provide the Municipality a copy of their Certificate of Liability Insurance prior to signing the contract and prior to commencement of any work under this contract.

GENERAL: The Contractor will not allow any subcontractor to commence work until the subcontractor has obtained insurance as listed in this section. The contractor and each subcontractor shall maintain this insurance throughout the life of this contract, including any maintenance and/or guarantee/warranty period. The contractor shall obtain separate insurance certificates for each contract.

ADDITIONAL INSURED: The Municipality of Anchorage shall be listed as an additional insured on all General and Auto Liability policies required by this contract. All policies shall contain a waiver of subrogation against the Municipality, except Professional Liability. All policies shall remain in effect during the life of the contract. The Contractors insurance certificate shall also indicate the Municipality of Anchorage as a certificate holder of the policy.

WORKERS COMPENSATION: The Contractor shall purchase and maintain during the life of this contract, workers compensation insurance for all employees who will work on this project and, if any work is sublet, the Contractor shall require the subcontractor similarly to provide such insurance. Employers' Liability with a minimum limit of $500,000 shall be maintained and Workers Compensation with minimum limits as required by Alaska State Workers Compensation Statutes. The policy shall contain a waiver of subrogation against the Municipality.

NOTICE TO "OUT-OF-STATE" CONTRACTORS WORKING IN ALASKA: The Contractor shall provide evidence of Workers Compensation insurance, either State of Alaska Workers Compensation coverage or an endorsement to the Contractor's home state Workers Compensation policy, evidencing coverage for "other states" including Alaska, prior to execution of a contract or, if approved, before commencement of contract performance in Alaska.

GENERAL LIABILITY: The Contractor shall purchase and maintain, in force, during the life of this contract such general liability insurance as shall protect the Owner and the Contractor against losses which may result from claims for damages for bodily injury, including accidental death, as well as from claims for property damages which may arise from any operations under this contract whether such operations be those of the Contractor, a subcontractor or anyone directly or indirectly employed by either of them.

Commercial General Liability	**Minimum Limits**
Products/Completed Operations	$2,000,000
Personal & Advertising Injury	$1,000,000
Each Occurrence	$1,000,000
General Aggregate	$2,000,000
Medical Payments	$5,000
Commercial Auto Liability	**Minimum Limits**
Combined single limit (Bodily Injury and Property Damage)	$1,000,000
Including all owned, hired, and non-owned	
Workers Compensation and Employers Liability	**Minimum Limits**
Per Alaska statute	$500,000
Errors and Omissions	**Minimum Limits**
Professional Liability (Not required unless limits appear in space provided)	
Umbrella Liability	**Minimum Limits**
(Not required unless limits appear in space provided)	
$ _____ S.I.R.	

Each insurance policy required by this section shall require the insurer to give advance notice to the MOA/Contract Administrator prior to the cancellation of the policy. IF the insurer does not notify the MOA upon policy cancellation, it shall be the Contractor's responsibility to notify the MOA of such cancellation.

COMPLIANCE WITH LAWS

The Contractor shall observe and abide by all applicable laws, regulations, ordinances and other rules of the State of Alaska and/or any political subdivisions thereof, or any other duly constituted public authority wherein work is done or services performed, and further agrees to indemnify and save the Municipality of Anchorage harmless from any and all liability or penalty which may be imposed or asserted by reason of the Contractor's failure or alleged failure to observe and abide thereby.

(Remainder of Page Initially left Blank)

ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) shall be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
	PHONE (A/C, No, Ext):	FAX (A/C,
	E-MAIL ADDRESS:	

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
	INSURER A :	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	☐ ☐ CLAIMS-MADE ☐ OCCUR						MED EXP (Any one person)	$
	☐						PERSONAL & ADV INJURY	$
	☐						GENERAL AGGREGATE	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$
	☐ POLICY ☐ PRO - ☐ LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ☐ NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	☐ **UMBRELLA LIAB** ☐ OCCUR						EACH OCCURRENCE	$
	☐ **EXCESS LIAB** ☐ CLAIMS-						AGGREGATE	$
	☐ DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						☐ WC STATU-TORY LIMITS ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE ☐ N / A						E.L. EACH ACCIDENT	$
	OFFICER/MEMBER EXCLUDED? **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA	$
							E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

1. The Municipality of Anchorage is an additional insured on Auto and General Liability policies. All policies, including workers compensation, contain a WAIVER OF SUBROGATION against the Municipality, except Professional Liability, .
2. CANCELLATION: "Should any of the above described policies be cancelled before the expiration date thereof, notice will be delivered in accordance with the Policy Provisions."

CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

Authorized Representative

BIDDER'S CHECKLIST

INSTRUCTION TO BIDDER

I. GENERAL:

Bidders are advised that notwithstanding any instructions or implications elsewhere in this Invitation to Bid only the documents shown and detailed on this sheet need be submitted with and made part of their bid. Other documents may be required to be submitted after bid time, but prior to award. Bidders are hereby advised that failure to submit the documents shown and detailed on this sheet shall be justification for rendering the bid nonresponsive. Evaluation of bids for responsiveness shall be accomplished in accordance with Anchorage Municipal Code, Title 7.

II. REQUIRED DOCUMENTS FOR BID

NOTE: "Only the following listed items as marked with an "X" are required to be completely filled out and submitted with the bid."

__X__ Bid Proposal consisting of two (2) pages numbered BP-1 of 2 through BP-2 of BP 2. Bid Proposal Page **BP-2 of 2 must** be manually signed.

__X__ Erasures or other changes made to the Bid Proposal Sheet must be initialed by the person signing the bid.

__X__ Bid Bond, certified check, cashier's check, money order or cash shall be submitted with the bid in the amount indicated.

__X__ All Addenda issued shall be acknowledged in the space provided on the Bid Proposal sheet or by manually signing the Addenda sheet and submitting it prior to the bid opening in accordance with Anchorage Municipal Code 7.20.020C.

III. REQUIRED DOCUMENTS AFTER BID OPENING

The following documents are required within **five (5)** working days of notification by the Purchasing Office. Failure, in whole or in part, to submit the documents required below shall be grounds to determine the Bidder as non-responsible.

__X__ In accordance with AO No. 2019-130 (S), Anchorage Municipal Code 7.20.030 and 7.20.070, Contractor Questionnaire consisting of three (3) Pages, Prime Contractor Form Filled out by Prime Contractor **and** all known subcontractors. **Please review AO NO. 2019-130 (S), AMC 7.20.030 and 7.20.070, and the attached Contractor Questionnaire before submitting a bid.**

Municipality of Anchorage
Contractor Questionnaire

Contractors/Vendors wishing to qualify for award of a bid or proposal offered by the Municipality of Anchorage shall submit this completed form and any supplemental information requested by this form within five days following a request by the Purchasing Officer.

This form is to be filled out by the prime, and subcontractors that perform work "on-site". On-site is defined as the physical place or places where the building or work called for in the contract will remain, and any other site where a significant portion of the building or work is constructed, provided that such site is established specifically for the performance of the contract or project.

Contractor/Vendor Name: _____

Owner(s) of Company (if sole proprietorship or partnership): _____

_____

List all Alaska construction contractor's registration numbers, registration types and expiration dates of the Alaska business licenses held by your company in the past three years:

_____

_____

Has your company changed names, business license number, or contractor registration number in the past three years?

☐ Yes ☐ No

If "Yes," explain on a separate signed page, including the reason for the change.

Has any owner, partner or (for corporations) officer of your company operated any business offering similar services outlined in the bid or proposal under any other name in the past three years?

☐ Yes ☐ No

If "Yes," explain on a separate signed page, including the reason for the change.

Certifications & Disclosures

For these questions & certifications, "company" includes any entity that shares or has shared majority ownership or control with your company. "Determination of violation" includes any citations, orders or recommendations issued to or against the company.

Debarment

1. In the last three years has your company been debarred from bidding on, or being awarded, a state or federal project?

   ☐ Yes ☐ No

Occupational Safety & Health

Note: Only willful violations of state or federal occupational safety and health laws will result in disqualification; disclosure of other violations does not lead to automatic disqualification.

2. In the last three years has your company been determined to have committed a **willful violation** of state or federal occupational safety and health law? For purposes of this question, a state or federal occupational safety and health law includes laws enforced by the Occupational Safety and Health Administration (OSHA), Alaska Occupational Safety and Health (AKOSH), or another state's occupational safety and health agency.

☐ Yes ☐ No

3. In the last three years, has the federal Occupational Safety and Health Administration (OSHA), Alaska Occupational Safety and Health (AKOSH), or another state's occupational safety and health agency, made a determination of violation against your company?

Note: If you have filed an appeal of a citation and the appropriate appeals board has not yet ruled on your appeal, you need not include information about it.

☐ Yes ☐ No

If "Yes," attach a separate signed page describing each citation.

Wage & Hour

Note: Only willful violations of state or federal wage and hour laws will result in disqualification; disclosure of other violations does not lead to automatic disqualification.

4. In the last three years has your company been determined to have committed a **willful violation** of state or federal wage and hour law?

☐ Yes ☐ No

5. In the last three years has there been a determination of violation of wage and hour laws against your company? Wage and hour violations include failure to pay minimum wages, overtime, or prevailing wages.

☐ Yes ☐ No

If "Yes," attach a separate signed page describing each violation, identifying the claim by claimant, date, and status/outcome.

Unemployment Insurance & Workers' Compensation

6. In the last three years has there been a determination of violation of unemployment insurance or workers' compensation requirements against your company?

☐ Yes ☐ No

If "Yes," attach a separate signed page describing each violation, identifying the claim by claimant, date, and status/outcome.

Licensing & Registration

7. If a license or certificate of fitness is required to perform any services provided by your company, has there been a determination of violation of any certificate of fitness requirements against your company in the last three years?

☐ Yes ☐ No

If "Yes," attach a separate signed page describing each violation, identifying the claim by claimant, date, and status/outcome.

Subcontracting

8. I certify that all independent subcontractors engaged by my company meet the definition of an independent contractor under Alaska Statute 23.30.230.

☐ Yes ☐ No

9. I understand that my company is responsible for ensuring that each subcontractor my company uses on the project completes this form and associated documentation. I will submit any disclosures required by Anchorage Municipal Code.

☐ I understand

10. I understand that my company is responsible for providing this form and any associated documentation for each subcontractor hired after award within 30 days of hire, and that the subcontractor may not begin work on the project until such information is provided.

☐ I understand

11. I understand that my company is responsible for ensuring that if any event, such as a violation or loss of coverage, causes the information submitted by the subcontractor to change, the subcontractor shall submit updated certifications or disclosures within 30 days of occurrence to the department contract administrator.

☐ I understand

I declare under penalty of perjury that the foregoing is true and correct.

Dated: _____ _____
(Signature)

_____
(Printed name and title)

Right to Appeal: Anchorage Municipal Code provides that any person adversely affected in connection with the award of a municipal contract, including the Municipality's determination on responsibility, may request that the mayor or assembly refer the matter to the bidding review board.

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION VI

BID PROPOSAL

BID PROPOSAL
(CERTIFICATION)

TO: MUNICIPALITY OF ANCHORAGE _____, 2022
PURCHASING DEPARTMENT
632 W. 6TH AVENUE, SUITE 520
ANCHORAGE, ALASKA 99501

SUBJECT: Invitation to Bid No. 2022C045

PROJECT TITLE: GWWTF Aeration System and Blower Upgrades Project

Pursuant to and in compliance with subject Invitation to Bid, and other bid documents relating thereto, the bidder hereby proposes to furnish all labor and materials and to perform all work for the construction of the above referenced project in strict accordance with the bid documents at the prices established in the Bid Proposal, page **BP- 1 of 2 through BP- 2 of 2** submitted herewith.

The bidder agrees, if awarded the contract, to commence and complete the work within the time specified in the bid documents.

Basic Bid; Lump Sum **$** _____

The bidder acknowledges receipt of the following addenda:

Addenda No._____ Addenda No. _____
Addenda No._____ Addenda No. _____
Addenda No._____ Addenda No. _____

Enclosed is a Bid Bond in the amount of _____.
(Dollar Amount or Percentage of Bid)

Type of Business Organization
The bidder, by checking the applicable box, represents that it operates as ( ) a corporation incorporated under the laws of the State of _____, ( ) an individual, ( ) an LLC, ( ) a partnership, ( ) a nonprofit organization, or ( ) a joint venture. If a partnership or joint venture, identify all parties on a separate page.

Is this project Federally Funded?
Yes ☐
No ☒

_____
Company Name

BID PROPOSAL
(CERTIFICATION)
Continued

SUBJECT: Invitation to Bid No. 2022C045

PROJECT TITLE: GWWTF Aeration System and Blower Upgrades Project

Date	Alaska Contractor's License Number
Company Name (Printed)	Employer's Tax Identification Number
Authorized Representative Signature	Printed Name & Title
Company **Mailing** Address	Company Phone Number
City, State, Zip Code	Company Fax Number
Company **Physical** Address (if different from mailing address)	Company Email Address
City, State, Zip Code	

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION VII

OTHER UTILITY REQUIREMENTS

CEA Facility Requirements

ENSTAR Safety Requirements

CHUGACH
POWERING ALASKA'S FUTURE

December 7, 2020

ELECTRICAL FACILITY CLEARANCE REQUIREMENTS

Enclosed please find a copy of Chugach Electric Association, Inc.'s (Chugach) Electrical Facility Clearance Requirements policy. Periodically, copies of this policy are mailed out to various companies and agencies whose activities may bring their personnel in close proximity to Chugach's electrical facilities. Chugach distributes copies of this policy in an effort to help minimize and identify potential hazards for construction personnel and the general public. In addition, Chugach is concerned with preventing damage to its electrical facilities and any disruption of electrical service to its customers. Please note that the Electrical Facility Clearance Requirements publication may be found on Chugach's website at: www.chugachelectric.com. Click on the "Member Services" tab and go to "Regulations & Requirements", click on "Electrical Facility Clearance Requirements" (December 7, 2020).

For your additional information, Alaska State Statute ("AS 42.30.400 " Excavator's Notice of Proposed Excavation") has been included as an attachment.

Please thoroughly read and understand the entire document. It could save your life or the life of your employees and the public. We request that particular attention be paid to the following provisions:

(Paragraph B. 2.) "Under no circumstances will Chugach allow any of its underground cable(s) to remain energized after it has been exposed, unless it is protected by supplementary mechanical protection approved by Chugach or unless a *qualified person* is on site at all times".

(Paragraph H. 7.) "Chugach defines a *qualified person* as a journeyman lineman who holds a current Certificate of Fitness in the Journeyman Lineman category issued by the State of Alaska". These two provisions clearly emphasize Chugach's position relating to the exposure and approach to energized facilities.

Chugach strongly recommends that prior coordination takes place between Chugach and the construction entity or contractor , either during the design phase of a project or prior to the start of construction, to help eliminate or minimize conflicts. If you have questions, please contact the Line Operations Division at (907) 762-7679 and your call will be directed to the appropriate department for assistance.

Sincerely,

James Mullican

James Mullican
Senior Manager Line Operations

Enclosures

cc: MOA Development Services; State of Alaska OSHA Inspector; SOA Electrical Inspector; AGC, Cook Inlet Housing, GCI, ACS, Enstar, AWWU, Anchorage Home Builders Association

CHUGACH ELECTRIC ASSOCIATION, INC.

CLEARANCE REQUIREMENTS FOR CONSTRUCTION OR MAINTENANCE NEAR ELECTRICAL FACILITIES

Chugach's concern for the safety of non-qualified personnel working adjacent to its electrical facilities, its concern for the public in general, and its requirement that only *qualified personnel* under the employ of *qualified electrical contractors* handle electrical facilities such as conductors, cables, poles, transformers, padmounted equipment, etc., is based upon the following considerations:

- The potential for serious injury and resulting liability is extremely high when dealing with all electric utility voltage levels up to 230,000 volts on overhead and underground lines.

- Certain types of equipment, particularly cable, can easily be damaged by improper handling. For example, when cable is hit or improperly suspended (common during excavation adjacent to cables), the scraped, cut, or stressed insulation will almost always result in premature cable failure. The highest risk to unqualified personnel is a cable failure while the cable is being handled during excavation or construction. Undetected cable damage may result in a subsequent cable failure with consumer outages for periods of up to a week's duration during winter conditions.

- The inherent stability of overhead pole lines or padmounted equipment is jeopardized with improper excavation and backfill, often resulting in hazardous voltage exposure to the public and contractors and leads to consumer power outages.

The above concerns can be minimized by the use of properly trained, licensed, and certified electrical outside linework personnel. The National Electrical Safety Code (NESC), the United States Occupational Safety and Health Administration (OSHA) and the Alaska State OSHA support this position as well as the clearances addressed herein.

The NESC, defines *"qualified"* as *"Having been trained in and having demonstrated adequate knowledge of the installation, construction, or operation of lines and equipment and the hazards involved, including identification of and exposure to electric supply and communication lines and equipment in or near the workplace."* Only qualified persons are permitted to handle or work on or adjacent to energized electrical facilities. This includes not only overhead pole lines but also padmounted

and underground facilities. Within the NESC, two rules specifically address the need for qualified persons to perform work on or near energized facilities:

> Rule 420B1 states, *"Employees whose duties require working on or in the vicinity of energized equipment or lines shall perform only those tasks for which they are trained, equipped, authorized, and so directed. Inexperienced employees shall: (a) work under the direction of an experienced and qualified person at the site; and (b) perform only directed tasks."*
>
> Rule 420B4 states, *"Employees who do not normally work on or in the vicinity of electric supply lines and equipment but whose work brings them into these areas for certain tasks shall proceed with this work only when authorized by a qualified person."*

OSHA 29CFR 1910.269 contains the training and documentation requirements for a qualified person.

OSHA 29CFR 1926.1408 addresses equipment operations near electrical lines. If any part of the equipment, when operated up to the equipment's maximum working radius, could get closer than twenty (20) feet to a power line, then the operator must notify the utility, verify line voltage, and implement one of the safety options in OSHA 29CFR 1926.1408.

At no time may equipment violate minimum required clearance to an energized power line: ten (10) feet for lines up to 50 kilovolts (kV), or ten (10) feet plus 0.4 inches per one (1) kV over 50 kV. Minimum clearances are provided below for common Chugach system voltages.

CHUGACH SYSTEM VOLTAGES	
Normal Voltage (Phase-to-Phase)	**Minimum Clearance Required At All Times**
Operations Near High-Voltage Overhead Power Lines to 50 kV	10 Feet
Over 50 kV to 200 kV	15 Feet
Over 200 kV to 350 kV	20 Feet

Specifically, 29CFR1926.1408 (b)(4)(ii) requires a "Safety Observer" during equipment operations if the equipment is operating where it is difficult for the operator to maintain twenty (20) feet of clearance to the overhead power line(s) by visual means. Alaska Statutes (AS) Sections 18.60.670 through Section 18.60.695 govern placement and operation of equipment near electrical lines or conductors. 29CFR1926, Subpart P addresses the specific requirements involved with trenching operations. These include prior notice to utility companies, prior location of utility facilities, and proper supports once the facilities are exposed. Furthermore, 29CFR Sections 1910.180; 1910.333; 1926.416; and 1926.651 regulate activities relative to job site electrical facilities.

In summary, Chugach's concern for the safety of all personnel affected by work adjacent to its energized facilities has led to the development of the attached policy.

ELECTRICAL FACILITY CLEARANCE REQUIREMENTS

The following requirements have been developed to help provide a safer work site to those personnel working adjacent to Chugach's electrical facilities and to protect Chugach facilities that are in proximity to the area of work being done by State or Municipal entities and private construction and maintenance projects.

A. NOTIFICATION

It is recommended that Chugach be informed of construction/maintenance activities as early as possible in the design process and be included in timely plan reviews. Any work that needs to be performed on Chugach facilities must have prior Chugach approval.

1. Overhead Facilities

Any work in the proximity of overhead power lines shall be preceded by a call to Chugach at (907) 762-7679 , at least 48 hours in advance, as notification of the planned work and compliance with OSHA 29CFR1926 (1408), and AS 18.60.670. If equipment, tools, machinery, or material must work in proximity closer than the minimum clearances outlined in OSHA 29CFR1926 (1408), and AS 18.60.670, the requirements of AS 18.60.680 shall be implemented before work can proceed. All necessary arrangements with Chugach by the requesting party for compliance with AS 18.60.680 shall be arranged in advance of the project start date.

2. Underground Facilities

Alaska Statutes 42.30.400 through 42.30.490, Anchorage Municipal Code, 24.40 and 26.90, and 29CFR1926, Subpart P place requirements on contractors who will be excavating around or adjacent to underground utilities. Advance notification requirements, underground facility locates, and the responsibilities for protection of utility facilities by contractors are specified in these regulations. All requests for locates of Chugach's underground facilities are to be made through the Alaska Digline at 811. Prior to excavation, Chugach's Line Operations Department shall be contacted at (907) 762-7679 a minimum of two (2) business days in advance of construction.

Locate surface markings are only reasonably accurate to +/- two (2) feet. Chugach and State law require hand-digging within two (2) feet of locate marks. In some cases, hand-digging may be required within three (3) or four (4) feet of the markings, depending on the facility involved and field

conditions at the project site. Maintaining locate marks is the responsibility of the party requesting the locate. Chugach may charge for re-locating and re-marking facilities that were previously marked.

B. UNDERGROUND CABLE EXCAVATION

1. Any excavation which is within a three (3) foot radius of a cable and parallels a cable for a distance greater than twenty (20) feet in length (see Section H.1 below) may require relocation of that cable. Excavations shorter in length and/or closer may also require relocation. At a minimum, cables that will require exposure must be exposed by *hand-digging* only, by a *qualified person* under the employ of a *qualified electrical contractor* (see Section H). See Drawing No. F-062388 attached.

2. Any excavation, such as a trench which crosses cable and/or conduit, shall be limited to twenty (20) feet in width and have provisions for the exposed cable/conduit to be supported every two (2) feet on a Chugach approved support system, to prevent cable damage. The cable support work and excavation within the three (3) foot radius (see Section H-1) shall be performed by a *qualified* person under the employ of a *qualified electrical contractor.*

   NOTE: When excavation must occur within the limits specified in B.1, and B.2, above, reasonable efforts will be made by Chugach to de-energize the cable if system conditions and personnel requirements allow. Even if the cable has been de-energized, a "Cable Watch" by a qualified person under the employ of a qualified contractor is still required. To request the de-energization of the cable, contact the Chugach Line Operations Department at (907) 762-7679 and your call will be directed to the appropriate department for assistance. Requests must be made three (3) business days in advance of the outage date requested. For emergencies, contact Chugach's Dispatch Center at (907) 762-4660.

   Under no circumstances will Chugach allow any of its underground cable(s) to remain energized after it has been exposed, unless it is protected by supplementary mechanical protection approved by Chugach or unless a qualified person is on site at all times.

3. Should any cable be exposed by non-qualified personnel, Chugach must be immediately contacted for field investigation before work may resume in the immediate area of such exposed cable.

Chugach recognizes that reasonable continuation of work may be required around energized underground cables after Chugach inspects the site. When this occurs, it is the responsibility of the construction contractor working at the site to arrange for qualified personnel as well as payment of the costs of said personnel and/or equipment. Chugach will neither arrange for, nor provide qualified personnel to satisfy this requirement unless Chugach determines this course of action is in its best interest, on a case-by-case basis. Where Chugach is otherwise forced to subsequently take steps to ensure the safety of the site, Chugach will advise the construction contractor that Chugach will pass these costs to the construction contractor.

4. In all cases, a final minimum burial depth of forty (40) to sixty (60) inches for primary-voltage (above 1000 volts) circuits and thirty (30) inches for secondary voltage (480V or below) circuits shall be maintained. If, however, existing Federal, State, or Municipal permit conditions require depths in excess of forty (40) inches, then the cable/conduit shall be buried at the depth required in the permit. The depth is measured from the top of the cable/conduit to final grade at the shallowest depth. Burial shall be in compliance with Chugach Construction Standard SUR 2-3, 5 or 6 (supplied upon request).

5. Projects that will increase final grade to sixty (60) inches or greater above Chugach direct buried cable shall require relocation at the customer's expense. Where cables are in conduit, review and written approval by Chugach is required for proposed grade changes resulting in a burial depth of sixty (60) inches or greater.

6. Projects which propose to modify the grade over Chugach's underground cables/circuits at voltages above 25kV require review and written approval by Chugach in all cases.

7. Excavations near underground cable/circuits energized above 25kV will require the following:

   a) Excavation Adjacent to Cables/Circuits Energized Above 24kV
   Chugach will require its Locate Contractor to notify excavators when a locate request includes the locating of cables are energized above 25kV.

   When excavation is planned that will come within ten (10) feet, expose, parallel, or undermine sections of Chugach's underground cables energized above 25kV, special precaution and safety

consideration must be taken. These distribution and sub-transmission cables operate at voltages of 34.5kV (34,000 volts) and transmission cables operate above 34.5kV up to 230kV (230,000 volts), provide power to tens of thousands of Chugach customers and require extraordinary protection. The following guidelines shall apply:

Chugach Line Operations Department shall be contacted at (907) 762-7679 in advance of the planned excavation a minimum of five (5) business days prior to beginning excavation. Chugach requires that a *qualified person* be on site at all times during excavation activity that comes within ten (10) feet of any circuit cable energized above 24kV. The contractor shall arrange and pay for a *qualified person* from Chugach or, with approval, from one of Chugach's approved and *qualified contractors*. Excavations closer than ten (10) feet shall require exposure of the cables (vac-truck, pot-holing or other approved means) at the intersecting point or at intervals of not less than every twenty-five (25) feet for parallel excavations by *qualified personnel* to determine the exact location of the cable prior to machine excavation.

Excavations within ten (10) feet of cables energized above 25kV can expose unqualified workers to potentially high fault currents and extremely unsafe conditions. Prior planning by the construction contractor with coordination and approval from Chugach for any excavation projects within ten (10) feet of circuits or cables energized above 25kV is mandatory.

Chugach may require a special locate utilizing Ground Penetrating Radar to locate critical facilities. "Pothole" locates utilizing vacuum excavation in conjunction with an air-knife tool may be used, with Chugach approval.

C. STRUCTURE EXCAVATION

1. Equipment Pads or Vaults

Temporary excavation is allowed with a maximum slope of 1:1 beginning three (3) feet from the exterior edge of a concrete pad or vault. The final grade shall consist of a level area radiating out a minimum of four (4) feet, measured from the exterior edge of the pad or vault, and a maximum slope of 2:1 beginning from that four (4) foot distance from the exterior edge of the pad or vault. For both temporary and final grade situations, a level

area extending ten (10) feet out from the edge of the concrete pad in front of equipment doors or access panels is necessary. Refer to Drawing No. F-062388 attached.

If the slope cannot be maintained at the grades specified above, additional protection such as barriers or piling is required. All shoring and excavation (closer than the above limits) shall be done by a qualified person(s) under the employ of a qualified electrical contractor.

2. Concrete-Encased Duct

Excavation wider than five (5) feet under a concrete-encased duct requires a method designed and certified by an Alaska-registered civil engineer and approved by Chugach. Installation of the temporary shoring or bracing shall be done under the supervision of a qualified person under the employ of a qualified electrical contractor.

D. POLE/GUY ANCHOR EXCAVATION

Excavation beginning no closer than a three (3) foot radius from a pole or guy anchor in stable soil conditions or a ten (10) foot radius from a pole or guy anchor in organic/unstable soil conditions is allowed, provided the slope from that point does not exceed 1:1. Refer to Drawing No. F-062388 attached.

Excavation closer than the limits defined above or within a ten (10) foot radius of more than one consecutive pole where excavation will be open while more than one pole is affected, may require shoring of each pole. Chugach review and approval of a shoring plan is required for all excavations where more than one pole is subject to an open excavation. Pole shoring shall be approved by Chugach for the specific excavation. All work for installing poles must be performed within OSHA guidelines. Shoring by other methods requires prior approval by Chugach on a case-by-case basis. Streetlight poles may be temporarily removed, subject to a written agreement with Chugach, prior to excavation.

Any excavation that may expose the pole butt requires a structural analysis of the pole shoring method. The analysis shall be performed by an Alaska-licensed professional engineer familiar with electrical transmission and distribution design standards in use by Chugach. Chugach also reserves the right, at contractor expense, to have a structural engineer examine any excavation deeper than the pole butt within a fifteen (15) foot radius of the pole.

All shoring and excavation (closer than the above limits) shall be done by a qualified person under the employ of a qualified electrical contractor.

E. RELOCATION REQUIRED

Where protection of the cable and structures cannot be maintained, as required in Sections A, B, and C, relocation of those facilities will be required prior to the intended work and at the contracting agency's expense.

F. BACKFILL

Replacement backfill for electrical facilities must be in accordance with Chugach specifications and performed by a qualified person under the employ of a qualified electrical contractor.

A damaged underground facility may not be reburied until it is repaired or relocated to the satisfaction of Chugach.

G. INSPECTION AND APPROVAL

All work on or in the immediate vicinity of Chugach facilities, such as backfilling, temporary support, shoring, and relocations are subject to prior approval and inspection by Chugach. On large projects where inspection time is substantial, all costs for inspection shall be the responsibility of the agency or entity contracting for the work. Reimbursement to Chugach shall be in accordance with Chugach's tariff, Section 8.

For any questions or approvals involving these requirements contact Chugach Line Operations at (907) 762-7679 and your call will be directed to the appropriate department for assistance.

H. MISCELLANEOUS

1. Depending on the soil type, depth and length of the excavation, type of Chugach facility involved, and the certainty of the cable locate markings, excavations can be approved within a two (2) foot radius of cable on a case-by-case basis.

2. Stable soil conditions are defined as all dry and non-organic. Soil conditions shall be evaluated and approved on a case-by-case basis by Chugach. The evaluation will be done using 29CFR1926, Subpart P, "*Excavations*" as a guide.

3. Excavation, except as noted, shall be defined as mechanically performed by a backhoe, trencher, scraper, grader, auger, or other equipment.

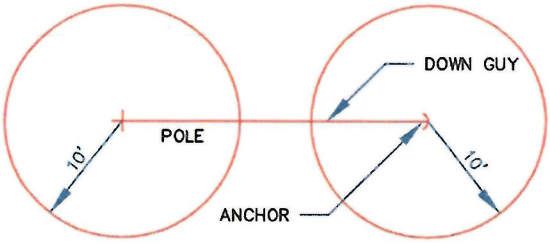
4. Cables are defined as insulated conductors whether buried directly or in conduit. The guidelines for cables also include 600-Volt pedestals and other small electrical apparatus associated with cables but not included under pads or vaults.

5. Spare conduit is not included in these provisions except to the extent of providing temporary support when exposed and inspected by Chugach prior to the placement of proper backfill.

6. Chugach defines a *qualified electrical contractor* as a contractor registered in the State of Alaska who has an Electrical Administrator's License in the Outside Linework category; or who has an employee with an Electrical Administrator's License in the same category registered with the contractor.

7. Chugach defines a *qualified person* as a journeyman lineman who holds a current Certificate of Fitness in the Journeyman Lineman category issued by the State of Alaska.

8. Chugach defines *hand-digging* as the removal of soil with hand tools, an air-knife tool (compressed air jet), or a vacuum truck.

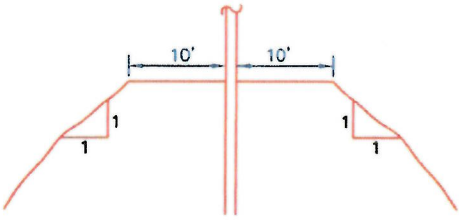


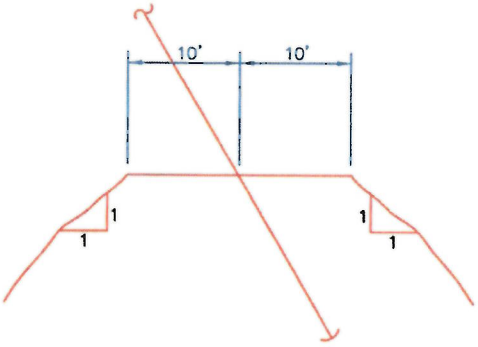
PLAN

(RADIUS OF UNDISTURBED SOIL)

NOTE:

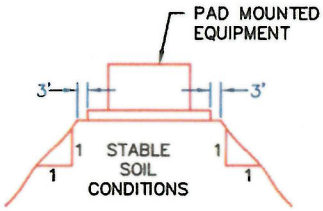
FOR VERY UNSTABLE SOIL CONTACT CHUGACH ELECTRIC.





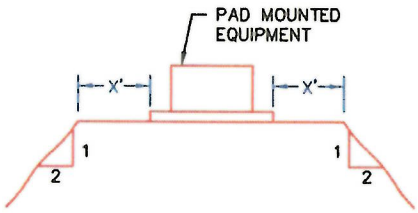
PROFILE

POLES/GUYS



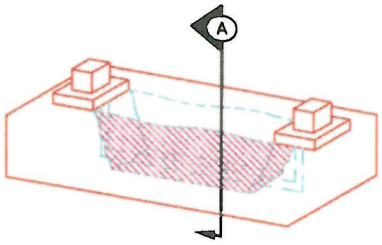
DURING CONSTRUCTION

SUPPLEMENTAL SUPPORT REQUIRED FOR EXCAVATIONS WITHIN 5' OF PADMOUNTED EQUIPMENT LOCATED ON UNSTABLE SOIL CONTACT CHUGACH ELECTRIC

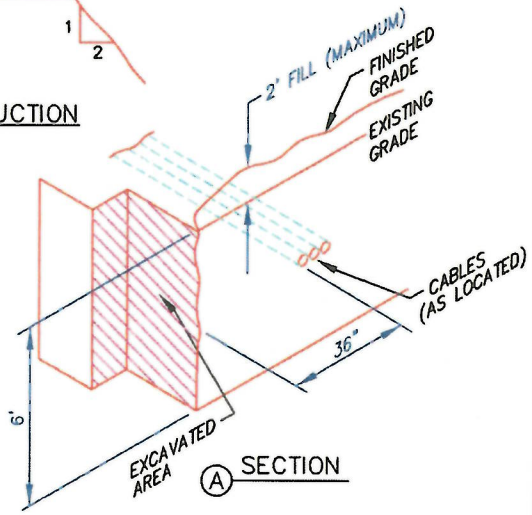


AFTER CONSTRUCTION

X': 10' ON DOOR/ACCESS SIDES. 4' ON OTHER SIDES.



PARALLEL EXCAVATION



STRUCTURES/CABLES

REV. NO.: 3 DATE: 1/28/98

Standards Engineer: _____

Mgr., Dist. Engineering: _____

Mgr., Const. & Maint.: _____

Dir., T&D Services Div.: _____

Chugach Electric Association, Inc.

EXCAVATION LIMITS

DEFINITION OF LIMITS REQUIRING NO ADDITIONAL STRUCTURAL SUPPORT

DRAWING NUMBER F-062388

SHEET 1 OF 1

Sec. 42.30.450. Waiver of requirements by written agreement.

An operator and an excavator may, by written agreement, waive the requirements of AS 42.30.400 - 42.30.490 that the excavator notify the operator of planned excavations and that the operator locate underground facilities. The agreement must identify the geographic areas to which the waiver applies and the time period for which the waiver is valid.

Sec. 42.30.460. Underground facility owner.

If the operator of an underground facility is not the owner of the facility and if the operator cannot be identified or has been identified but cannot be reached in a reasonable amount of time, the excavator may give the notice required by AS 42.30.400 - 42.30.490 to the owner of the underground facility and the owner shall assume the duties and responsibilities of the operator under AS 42.30.400 - 42.30.490.

Sec. 42.30.490. Definitions.

(1) "damage" means

(A) the substantial weakening of structural or lateral support of an underground facility;

(B) penetration, impairment, or destruction of any underground protective coating, housing, or other protective device; and

(C) the partial or complete severance of an underground facility to the extent that the project owner or facility operator determines that repairs are required;

(2) "emergency" means

(A) a condition that constitutes a clear and present danger to life, health, or property; or

(B) an unplanned service interruption;

(3) "excavation" means

(A) an activity in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means;

(B) road maintenance that changes the original road grade;

(C) demolition or movement of earth by equipment, tools, or explosive device except tilling of the soil less than 12 inches in depth for agricultural purposes;

(4) "excavator" means a person who conducts excavation in the state;

(5) "inaccessible" means impossible or unreasonably difficult to reach due to conditions beyond the control of the underground facility operator;

(6) "notification center" or "center" means a service through which a person is able to call one number to notify member operators of underground facilities that an excavation is proposed and to request the operators to mark facilities located inside of the proposed excavation area;

(7) "operator" means a person who supplies a service for commercial or public use by means of an underground facility;

(8) "person" means any individual, public or private corporation, political subdivision, government agency, municipality, industry, partnership, copartnership, association, firm, trust, estate, or any other entity whatsoever;

(9) "remote" means not accessible by road;

(10) "underground facility" means a pipe, sewer, conduit, cable, valve, line, or wire, including attachments and those parts of poles or anchors that are below ground, for use in connection with the storage or conveyance of water, sewage, telecommunications, cable television, electricity, petroleum, petroleum products, hazardous liquids, or flammable, toxic, or corrosive gas;

(11) "unstaffed" means not normally staffed with employees;

(12) "working day" means a day on which an underground facility operator is open for regular business.

ALASKA STATUTES

TITLE 42

PUBLIC UTILITIES & CARRIERS

Sec. 42.30.400. Excavator's notice of proposed excavation.

(a) Before beginning an excavation, an excavator shall give notice of the proposed excavation to each underground facility operator who has an underground facility in the area of the proposed excavation and request the operator to field mark the location of its underground facility. The excavator shall notify an underground facility operator who subscribes to a notification center by giving notice to the center. The excavator shall notify an underground facility operator listed in the applicable telephone directory who is not a subscriber to a notification center by giving notice directly to the operator.

(b) Except in the case of an emergency locate request or a request to locate in a remote, unstaffed, or inaccessible location, the excavator shall notify an underground facility operator who may have a facility in the area of a proposed excavation at least two but not more than 15 working days before the date scheduled for beginning the excavation. In the case of a request to locate in a remote or unstaffed location, the excavator shall notify the operator at least 10 but not more than 20 working days before the scheduled date for beginning excavation.

(c) In an emergency, the excavator shall immediately notify each underground facility operator in the area of the emergency and of the need for the excavation and request prompt location of underground facilities.

Sec. 42.30.410. Operator's response to request to locate; immunity related to unmarked or inaccurately marked facilities.

(a) An underground facility operator shall accept requests to locate underground facilities during the operator's regular business hours. An operator who receives a request to locate shall maintain for at least one year an accurate record of the request and responses to the request.

(b) When an underground facility operator receives a request to locate, it shall notify the excavator of the location of the underground facilities that the operator is able to field mark with reasonable accuracy and field mark those facilities. If the operator owns, uses, or operates an underground facility that is identified as being in the area of the proposed excavation but that the operator cannot field mark with reasonable accuracy, the operator shall provide the excavator with the best information available to the operator about its location and shall provide on-site assistance until the facility is located or until the excavator no longer needs assistance in locating that facility.

(c) The field marks for an underground facility buried 10 feet deep or less must be located within 24 horizontal inches of the outside dimensions of the facility. For a facility buried deeper than 10 feet, the operator shall locate the field marks within 30 horizontal inches of the outside dimensions of the facility. The operator shall use stakes, paint, or other clearly identifiable material to show the field location of the underground facility. The marker used to designate the approximate location of an underground facility must follow the current color code standard used by the American Public Works Association.

(d) Except for an underground facility in a remote, unstaffed, or inaccessible location, an underground facility operator shall respond to a request to locate promptly. A response is considered to be prompt if it is made within two working days after the operator receives the request or at a later time so long as the response occurs before the beginning of the excavation. For an underground facility in an accessible remote or unstaffed location, the operator shall respond within 10 working days after the operator receives the request or at a later time so long as the response occurs before the beginning of excavation.

(e) After an operator has field marked an underground facility, the excavator is responsible for maintaining the markings.

(f) An excavator may not begin to excavate until each underground facility has been field marked.

(g) When an operator has field marked an underground facility once at the request of an excavator, the operator has the right to receive compensation from the excavator for costs incurred in responding to subsequent requests to locate the same underground facility during the same excavation project if the excavator failed to maintain the original marking.

(h) If an excavator discovers an underground facility that was not field marked or was inaccurately field marked, the excavator shall immediately stop excavating in the vicinity of the facility and shall notify the operator of the discovery. The excavator may notify the operator by means of a notification center. The operator shall treat the notification as a request to locate in an emergency and shall respond accordingly. An excavator may not be held liable for inadvertent damage caused to an unmarked or an inaccurately marked underground facility.

(i) Unless the request to locate is made in response to an emergency, an underground facility operator has the right to receive compensation for costs incurred in responding to a request to locate that gives the operator less notice than the minimum notice required by this section. This subsection may not be interpreted to require the operator to respond to the request to locate within the time requested in the notice.

Sec. 42.30.420. Responsibility of construction project owners.

The owner of a construction project that will require excavation shall indicate in bid documents or contracts for construction the existence of underground facilities that the project owner knows are located inside of the proposed area of excavation. This requirement does not release the excavator from the excavator's responsibility under AS 42.30.400 - 42.30.490.

Sec. 42.30.430. Obligations concerning the conduct of excavations.

(a) An excavator shall use reasonable care to avoid damaging an underground facility. The excavator shall

(1) determine, without damage to the facility, the precise location of an underground facility whose location has been marked;

(2) plan the excavation to avoid damage to and minimize interference with an underground facility in or near the excavation area; and

(3) to the extent necessary to protect a facility from damage, provide support for an underground facility in and near the construction area during the excavation.

(b) An excavator who, in the course of excavation, contacts or damages an underground facility shall notify the operator. If the damage causes an emergency, the excavator shall also alert appropriate local public safety agencies and take reasonable steps to ensure public safety. A damaged underground facility may not be reburied until it is repaired or relocated to the satisfaction of the operator. The operator of an underground facility that was damaged during excavation shall arrange for repair or relocation of the facility as soon as practical.

Sec. 42.30.440. Penalties; injunctive relief.

(a) In addition to all other remedies provided by law, a person who violates a provision of AS 42.30.400 - 42.30.490 is subject to a civil penalty of not less than $50 nor more than $1,000 for each offense if the violation results in or significantly contributes to damage to an underground facility.

(b) If the court finds that an excavator is violating or threatening to violate a provision of AS 42.30.400 - 42.30.490 and the violation may result in damage to an underground facility, the court may grant injunctive relief to the underground facility operator.

Safety Requirements For Excavation Adjacent To Natural Gas Pipelines

ENSTAR Natural Gas Company / Alaska Pipeline Company

Safety

ENSTAR Natural Gas Company provides natural gas service through 3,200 miles of gas mains to over 133,000 customers in South Central Alaska. ENSTAR's gas pipeline system is designed, installed, and maintained with the highest regard for safety in compliance with applicable federal, state, and local government statutes and regulations. ENSTAR is regularly inspected to ensure that its operation meets industry standards.

The US Department of Transportation, Pipeline & Hazardous Materials Safety Administration (PHMSA) oversees minimum safety regulations for the transportation of natural gas by pipelines. The DOT safety regulations are currently published in Title 49, Part 190, 191, 192 & 199 of the Code of Federal Regulations (CFR).

As an operator of a natural gas system, ENSTAR is required by the DOT regulations to:

1. Deliver gas safely and reliably to customers.
2. Provide training and written instruction for employees.
3. Establish written procedures to minimize hazards resulting from gas pipeline emergencies.
4. Keep records of inspections and testing.
5. Test employees in safety-sensitive positions for prohibited drugs and alcohol.

Pipeline Reliability

Safety is and always will be unequivocally the number one priority for the natural gas industry. The industry spends billions of dollars each year to ensure the safety and reliability of the natural gas infrastructure. Natural gas utilities are subject not only to their own stringent internal controls, but also must meet rigorous federal and state oversight. Inspections are performed regularly by PHMSA regulators to ensure that compliance is being met.

Historically, excavation damage is the leading cause of most serious pipeline failures. Over 50% of the 312 damages to ENSTAR's pipelines last year were done by excavators that failed to obtain locates. Call before you dig, it's free and it's the law. Calling for locates is now as simple as dialing **811**. Dialing **811** anywhere in the United States connects you with the Locate Call Center for that area. In Alaska, dialing **811** connects you with Alaska Digline Inc. Alaska Digline Inc. will take your excavation information and notify all affected utilities. Utilities have two business days to mark their utilities after receiving your call.

Pressure Classification

Natural gas is a potentially dangerous, compressible gas. Gas pipelines with the highest pressure contain the highest stored potential energy and present the greatest risk. Caution is always warranted when working around natural gas facilities. **Extreme caution must be exercised whenever transmission pipelines are encountered. Contact ENSTAR Engineering Dept., (907) 264-3740 for specific instructions before working within 10 feet of any transmission pipeline.**

Pressure Classification	Pressure Rating Range	Pipeline Material
Transmission Pressure	Greater than 60 psig	Steel
Distribution Pressure	60 psig or less	Polyethylene, Steel, Copper

Recognizing ENSTAR's Pipelines

ENSTAR transmission pipelines are generally marked above ground with pipeline markers similar to the one shown. Transmission pipelines are located in the vicinity of the pipeline markers. Transmission pipelines are steel and range in size from 4" to 20" in diameter. They are typically coated with a protective coating. There is no single color but yellow and black are the predominant color while some are green or brown.

Typical ENSTAR Pipeline Marker

Distribution pipelines are steel, copper or polyethylene with locate wire. These pipelines range in size from ½" diameter to 12" in diameter. Gas "Mains" are typically found in street right-of-ways or utility easements and supply the natural gas to an entire street or subdivision. They are typically steel or polyethylene and range in size from 2" to 12" in diameter.

Natural gas "service lines" are connected to the gas main. Service lines generally serve a single building or small group of buildings on private property. Service lines are typically ½" to 1" in diameter. Service lines can be rigid steel, steel tubing, copper or polyethylene with locate wire. Gas mains and service lines are generally black or yellow in color.

Excavation Requirements for Natural Gas Pipelines

1 **Line Locating is a Free Service:** To request a locate, dial **811** the new Nationally recognized One-Call number and you will be connected to Alaska Digline Inc. Call at least two but not more than 15 working days before the date scheduled for beginning the excavation. Hand digging is advised when excavating within 2 feet of a marked facility. After ENSTAR has field marked with yellow paint, or flagged the location of an underground facility, the excavator is responsible for maintaining the markings. **Failure to call is a violation of state statutes and could result in fines well in excess of the cost of the damage.**

2 **Support for Steel Line Crossings:** If an excavation below a **steel gas** pipeline leaves the pipeline unsupported for a distance of more than 20 feet, the excavator must provide additional support for the pipeline. Support must be provided in a way as to not damage the pipe or its coating during construction, backfill placement, and compaction. Generally, a support spacing of 5 feet or less will provide the needed bracing. ENSTAR Engineering must approve all excavations crossing steel pipelines above 4-inch diameter. If support is required, ENSTAR engineering written approval is required prior to beginning construction. Call ENSTAR Engineering (907) 264-3740 for further information. Extra care must be taken when geotextile fabric and/or rigid insulation are used. In addition to continuous support under the pipeline, compacted fill material shall be placed between the geotextile fabric/rigid insulation and the pipeline. Care shall be taken to insure stability for the ENSTAR facility. Failure to properly protect ENSTAR's facilities could result in future damage if differential settlement occurs.

3 **Support for Polyethylene Line Crossings:** If an excavation is below a **polyethylene gas pipeline** the excavator must continuously support such pipeline during construction, backfill placement, and compaction. Geotextile fabric and/or rigid insulation shall be sufficiently separated from the polyethylene gas pipeline to prevent undue stress during the compaction/settlement process. (see item 8 clearance)

4 **Excavation Parallel to Pipeline:** When parallel excavations are expected to expose or undermine sections of pipeline, the excavator must notify ENSTAR engineering in advance. Care must be taken not to damage the pipeline, or to induce stresses due to differential settlement following construction**. Long parallel excavations exposing pipelines can be very dangerous if not properly performed and shall not be attempted without prior approval by ENSTAR.** Contact ENSTAR Engineering at 264-3740 for additional information.

5 **Blasting:** All blasting that is to be done within 500' of any Company Facility, shall be reviewed by an ENSTAR engineer, with the person performing the blasting and appropriate measures, (i.e. require minimum distance from facilities, minimize blasting charge intensity, etc.) shall be taken to protect the integrity of the Company's Facilities. A leak survey shall be performed after any blasting activity, which is within 500' of any Company Facility. The leak survey zone shall include all Company Facilities within 500' radius of the blasting.

6 **Trenchless Excavation (Vertical or Horizontal):** **Whenever a trenchless excavation (horizontal or vertical) is performed within 5 feet of a distribution pressure pipeline and 10 feet of a transmission pressure pipeline, the gas pipeline must be exposed to visually determine the exact location.** If the trenchless excavation is expected to cross the pipeline within the aforementioned distances, the pipeline in question shall be fully exposed to a minimum of 1 foot beneath the pipeline prior to the expected crossing to ensure that the pipeline is not unduly damaged due to ground movement in the immediate vicinity of the pipeline. **When performing a trenchless excavation parallel to a gas pipeline, the gas pipeline must be exposed at intervals of 25 feet or less to visually determine the pipeline's exact location.** Trenchless excavation is defined as drilling, directional drilling, boring, pile installation etc.

7 **Clearance:** Natural Gas pipelines require a **12 inch minimum separation from other underground structures** not associated with ENSTAR's pipeline system. Additional clearance from other underground structures may be required to allow proper maintenance and reduce the possibility of damage due to the proximity of other structures (49 CFR § 192.325.) This clearance requirement includes rigid insulation and geotextile fabrics. **ENSTAR requires a 36-inch minimum separation from certain electrical facilities, including any grounded components i.e. ground rods, non-insulated conductors and associated structures.**

8 **Pipeline Cover:** ENSTAR pipelines in public rights-of-way are generally installed with 36 inches to 48 inches of cover, and in private rights-of-way with 12 inches to 36 inches of cover. Projects that decrease cover or increase cover in excess of 60 inches must receive prior approval from ENSTAR Engineering Department (907) 264-3740**.** ENSTAR has limited ability to prevent the removal of cover over gas pipelines. Increasing pipeline cover more than 5 feet or decreasing pipeline cover to less than 3 feet may be considered a damage that may result in relocation of the gas pipeline at the expense of the Excavator. The depth of cover listed above cannot be assumed after installation. The excavator is responsible for any damage to ENSTAR pipelines regardless of the depth at which they are encountered.

9 **Inspection:** All excavations in the immediate vicinity of ENSTAR Natural Gas facilities (including backfill, compaction, temporary support, and shoring), is subject to prior approval and inspection by ENSTAR personnel. Transmission pipeline inspections are provided whenever an excavator is working within ten feet of a transmission pipeline. If it has been determined that there was excavation either by hand or machinery within 5 ft. of ENSTAR Natural Gas Distribution mains or 10ft. from ENSTAR Natural Gas Transmission mains without either locates or standby (qualified ENSTAR personnel), ENSTAR Natural Gas reserves the right to excavate to determine if there has been any damage to ENSTAR Natural Gas facilities. If damage has occurred ENSTAR Natural Gas has the right to charge the excavator for repairs.

Pipeline Components

Pipe Wall Protection

Dents, scrapes, gouges and scratches reduce pipeline wall thickness and affect the safety of the facility in two ways. First, the reduced wall thickness decreases the pressure at which the pipeline can safely operate. Second, the damage serves as a stress concentration that can cause a future brittle failure of the pipeline. **An ENSTAR representative must inspect each dent, scrape, gouge or scratch, no matter how small, before it is reburied.**

Corrosion Protection

ENSTAR's **steel** pipelines are protected from corrosion by a dielectric coating and an impressed current or galvanic anode cathodic protection system. Direct contact with metallic objects (a short) or removal of the protective coating can compromise this system. Contact the ENSTAR Engineering Department (907) 264-3740, whenever coating damage or a short is encountered. **An ENSTAR representative must inspect each short or section of damaged coating before it is reburied.**

Locate Wire Protection

ENSTAR's **polyethylene** pipelines are installed with a parallel copper wire, which is used to locate the pipeline. If the locate wire or wire coating is damaged, ENSTAR's ability to properly locate the pipeline may be severely compromised. Electrical continuity must be maintained. **An ENSTAR representative must inspect each possible locate wire damage before it is reburied.**

Service Line Excess Flow Valves

Excess Flow Valve (EFV) is a safety device installed in a natural gas service line near the gas main that is designed to automatically shut off the flow of natural gas in the event that the service line is broken. Effective February 12, 2010, all gas companies nationwide were required to install an EFV in any newly installed service line that serves one single family dwelling.

ENSTAR will not be installing EFVs on service lines that branch to multiple buildings, multi-family, commercial or industrial structures. ENSTAR will not be installing EFVs on the existing 100,000 service line currently in use.

What does this mean to you as an Excavator?

Should you dig into a natural gas service line that has an EFV, the gas will blow for a short duration and shut off automatically if the flow of gas is sufficient to close the EFV. Damages that do not sever the service line completely may not cause the EFV to close and the gas will continue to blow. Regardless, **you must report all damages to ENSTAR immediately**. EFVs are designed to allow a small amount of "bleed-by" so they can be reset without excavating the gas main. Backfilling a damaged service line with gas bleeding underground is extremely dangerous and could fuel an explosion if it is not repaired timely. **Do not assume a damaged service is dead or abandoned if it is not blowing gas**. The EFV may have shut down the flow of gas. Report all damages immediately by calling 277-5551.

Please remember that the vast majority of ENSTAR service lines WILL NOT have an EFV. Should you damage a service line without an EFV, gas will blow at full line pressure until ENSTAR can arrive to shut it off. Your best protection against damaging underground utilities is to call **811** for locates and hand dig within 2 feet of the locate marks.

What to do if You Damage a Gas Line or Smell Gas

If you damage a pipeline facility, call ENSTAR's 24-hour dispatch number at 277-5551. Call ENSTAR any time a gas line is broken, scraped, pulled, cut or otherwise damaged. **If the damage results in a release of natural gas and there is a danger to life or property, you should call the local Fire Department or 911.** Eliminate all ignition sources and evacuate the area of the damage. Wait for an ENSTAR employee to shut off the flow of gas and make repairs.

Gas lines that have been pulled, stretched, kinked or bent could be damaged underground away from where the line is connected. If you pull or stretch gas lines call ENSTAR at 277-5551 and an ENSTAR Representative will investigate for possible underground leakage.

Qualified Personnel Requirements

Only qualified individuals meeting all applicable requirements may perform work on ENSTAR Natural Gas Company facilities. At a minimum, such individuals must comply with applicable federal, state and local regulation, statutes, and ordinances.

For further information about ENSTAR, visit our web site @ www.enstarnaturalgas.com

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION VIII

MINIMUM RATES OF PAY

State of Alaska Wage Rate

Laborers' & Mechanics' Minimum Rates of Pay

Title 36. Public Contracts AS 36.05 & AS 36.10 Wage & Hour Administration Pamphlet No. 600 (Pamphlet 600) is hereby incorporated in its entirety. Pamphlet 600 is available for free download at http://labor.alaska.gov/lss/forms/pamp600-090115.pdf

The Municipality of Anchorage will include a paper copy of the wage rates in the signed Contract.

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION IX

AWWU DISADVANTAGED BUSINESS ENTERPRISE PROGRAM (MBE/WBE)

(NOT USED)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION X

EEO CONTRACT COMPLIANCE SPECIFICATIONS

EEO Statement of Acknowledgement

EEO Special Provisions

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EQUAL EMPLOYMENT OPPORTUNITY STATEMENT OF ACKNOWLEDGEMENT

This statement of acknowledgement is required by the Equal Employment Opportunity Regulations of the Secretary of Labor (41 CFR 60-1.7(b)(1)) and must be completed by each Bidder and proposed Subcontractor participating in this contract.

PLEASE CHECK THE APPROPRIATE BOXES

THE ☐ Bidder ☐ proposed Subcontractor **hereby CERTIFIES:**

PART A. Bidders and proposed subcontractors with 50 or more employees and a federal contract amounting to $50,000 or more are required to submit one federal EEO-1 report during each year the two conditions (50 employees and a $50,000 federal contract) exist.

The company named below (Part C) is exempt from the requirements of submitting an EEO-1 report this year.

☐ NO (go to PART B) ☐ YES (go to PART C)

PART B. The company named below (Part C) has submitted an EEO-1 report this year:

☐ YES (go to PART C) ☐ NO (following reporting and instructions below)

On-line EEO-1 report filing may be accessed at the following web address:

https://egov.eeoc.gov/eeo1/eeo1.jsp , after EEO-1 go to PART C

EEO-1 reporting and instructions may be obtained by writing or e-mail to, although must be completed before proceeding to PART C:

EEO-1 Joint Reporting Committee
P.O. Box 78040
Washington, DC 20013-8040
Telephone 1-866-286-6440
Email: e1.techassistance@eeoc.gov

PART C.

_____ _____
Signature of Authorized Representative of Company Date

_____ (_____) _____
Name of Company Telephone No.

_____ _____
Address of Company Zip Code

_____ _____
Project Name Contract Number

EQUAL EMPLOYMENT OPPORTUNITY SPECIAL PROVISIONS

CONTRACT COMPLIANCE SPECIFICATIONS

Every municipal contract shall include language substantially the same as the following: The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, ancestry, age, sex, sexual orientation, gender identity, marital status, or physical or mental disability. The contract will comply with all laws concerning the prohibition of discrimination including, but not limited to, Title 5 and Title 7 of the Anchorage Municipal Code.

Every municipal contract shall state, in all solicitations or advertisements for employees to work under the contract, that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, ancestry, age, sex, sexual orientation, gender identity, marital status, or physical or mental disability.

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XI

RECORD DRAWINGS (PROVIDED SEPARATELY)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XII

SOIL BORING LOGS (NOT USED)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XIII

TEMPORARY CONSTRUCTION PERMITS AND EASEMENTS (NOT USED)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XIV

PERMITS (NOT USED)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XV

TRAFFIC CONTROL PLANS (NOT USED)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XVI

ANNOTATION SITE PHOTOGRAPHS (NOT USED)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XVII

HAZARDOUS MATERIALS SURVEY REPORT (NOT USED)

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XVIII

MAXIMO ASSET REPORTS

Equipment Organization and Classification Guide

Asset and Location Attributes Report

Asset Attribute Spec Report (A61)

Asset Details			
Asset	352684 BLOWER #1	Location	GWWTFPRCAEP AERATION PROCESS
Classification	BLOWER	Failure Class	BLOWER
Asset Tag	B-104	Installation Date	
Model		Instalfinancprojid	WM.00159
Serial #		Purchase Price	0.00
Vendor		Contractor Warranty Exp Date	
Manufacturer		Warranty Expiration Date	

Asset Attribute Spec Report (A61)

Asset Details			
Asset	352685 BLOWER #2	Location	GWWTFPRCAEP AERATION PROCESS
Classification	BLOWER	Failure Class	BLOWER
Asset Tag	B-105	Installation Date	
Model		Instalfinancprojid	WM.00159
Serial #		Purchase Price	0.00
Vendor		Contractor Warranty Exp Date	
Manufacturer		Warranty Expiration Date	

Asset Attribute Spec Report (A61)

Asset Details			
Asset	352686 AIR DIFFUSERS	Location	GWWTFPRCAEPAEB1 AERATION BASIN #1
Classification	AERATOR	Failure Class	LOUVER
Asset Tag		Installation Date	
Model		Instalfinancprojid	WM.00159
Serial #		Purchase Price	0.00
Vendor		Contractor Warranty Exp Date	
Manufacturer		Warranty Expiration Date	

Asset Attribute Spec Report (A61)

Asset Details			
Asset	352687 AIR DIFFUSERS	Location	GWWTFPRCAEPAEB2 AERATION BASIN #2
Classification	AERATOR	Failure Class	LOUVER
Asset Tag		Installation Date	
Model		Instalfinancprojid	WM.00159
Serial #		Purchase Price	0.00
Vendor		Contractor Warranty Exp Date	
Manufacturer		Warranty Expiration Date	

Asset Attribute Spec Report (A61)

Asset Details			
Asset	352688 AIR DIFFUSERS	Location	GWWTFPRCAEPAEB3 AERATION BASIN #3
Classification	AERATOR	Failure Class	LOUVER
Asset Tag		Installation Date	
Model		Instalfinancprojid	WM.00159
Serial #		Purchase Price	0.00
Vendor		Contractor Warranty Exp Date	
Manufacturer		Warranty Expiration Date	

Asset Attribute Spec Report (A61)

Asset Details			
Asset	352689 AIR DIFFUSERS	Location	GWWTFPRCAEPAEB4 AERATION BASIN #4
Classification	AERATOR	Failure Class	LOUVER
Asset Tag		Installation Date	
Model		Instalfinancprojid	WM.00159
Serial #		Purchase Price	0.00
Vendor		Contractor Warranty Exp Date	
Manufacturer		Warranty Expiration Date	

Municipality of Anchorage

Anchorage Water and Wastewater Utility

2022 WATER IMPROVEMENTS

GIRDWOOD WASTEWATER TREATMENT FACILITY AERATION SYSTEM AND BLOWER UPGRADES

SECTION XIX

DRAWINGS (UNDER SEPARATE COVER)

North Bay Water
Consulting Engineers LLC
2131 Belair Drive
Anchorage, AK 99517
Phone: 907-310-2238

MEMORANDUM

Date: November 27, 2020

To: Tom Winkler, P.E.
AWWU

From: Scott Boettcher, P.E.
North Bay Water Consulting Engineers LLC

Subject: Girdwood WWTF – Aeration System and Blower Evaluation

---

The purpose of this memorandum is to summarize the findings of the site visits and provide an evaluation of the existing aeration system blower equipment at the Girdwood Wastewater Treatment Facility (GWWTF or Facility). Based on site visits and discussions with operations staff, develop recommendations for installing an alternative configuration of the existing system to achieve operational cost savings and increase reliability.

Existing Aeration System

The existing activated sludge process relies on mechanical aeration to impart dissolved oxygen to the mixed liquor. The aeration is supplied by three (3) 75 Hp Spencer Turbo Compressors, multi-stage centrifugal blowers to produce a spiral mix-type aeration system in each of the four aeration basins. The air is delivered to the aeration basins through PVC piping and is forced through coarse bubble diffusers. The diffusers form a curtain of bubbles that both oxygenates the liquor and provides the necessary mixing action.

Photo 1 - Existing 75 Hp Spencer Turbo Compressor

Eliminating the piping to supply air to the lagoon and along with other recent process changes has reduced the overall air requirement. Operations staff have indicated that having one blower online provides more than enough aeration to satisfy the needs of the biological process. Unfortunately, the current system does not provide a means to automatically control the operation of the blower, and the excess aeration leads to substantially higher than necessary energy consumption at the Facility. Throttling is currently performed manually. Plant staff would prefer to have aeration control to be based on a signal from the existing dissolved oxygen (DO) probes.

There is a concern that the existing motor control centers (MCC) that support the blowers are in a classified hazardous area. Electrical classification requirements have changed significantly since the original Facility was constructed in 1978. Since that time, both the NEC and NFPA have increased safety (arc flash prevention) requirements for wastewater treatment facilities to address potential explosive gases entering the facilities or generated by the treatment process. It is understood that significant modifications to the blower system and associated electrical equipment would need to be performed in accordance with the current NFPA recommended practice for facilities of this nature. Under the current version of NFPA 820 (Standard for Fire Protection in Wastewater Treatment and Collection Facilities), process areas in the Facility would be classified areas due to the potential for accumulation of explosive or flammable gases. Since the Facility has limited physical and air space segregation between these areas, it is assumed that modifications to the blowers and associated electrical distribution equipment would be need to be performed in accordance with the requirements for classified areas, such as the adjacent headworks screenings area.

Additional concerns include the potential for water being sprayed on the blower electrical equipment from the nearby drum screens, should an equipment malfunction occur. These concerns are coupled with the obsolescence of existing electrical equipment, meaning spare parts are difficult, if not impossible to obtain for this legacy equipment.

Process Aeration and Mixing Requirements

At this stage of the evaluation, only a preliminary review of possible aeration demands was undertaken. Should the project advance to the design phase, efforts will be required to quantify process air and mixing requirements. As mentioned previously, the aeration basins are equipped with diffusers that are attached to the basin floor. The amount of aeration which is pumped through the diffusers determines the amount of mixing energy which is imparted to the basin. It is important to ensure that the aeration basins are provided the minimum amount of aeration to ensure that the mixed liquor in the basin remains in suspension.

There are general guidelines and rules of thumb for the amount of aeration which is required for mixing. One of the most widely used sizing criteria for 'spiral-mix' or 'roll-mix' aeration systems like GWWTF is to apply between 3 and 7 SCFM per foot of basin length. GWWTF operations currently run two of the four basins most of the time, but they have indicated that they would prefer the flexibility to run between 1 and 4 basins at any time. Each of the existing basins are 31 feet in length; therefore, for minimum mixing each online basin will theoretically require between 90 and 230 SCFM to maintain mixing. Because these values are rule-of-thumb generalities for mixing, the minimum amount of mixing aeration required for the basins at GWWTF will have to be determined to fully optimize the air delivery control strategy. In some treatment scenarios, additional aeration will be needed to handle the BOD loading, but in most cases the DO transfer achieved with the mixing will cover the needs of the BOD loading (especially when a greater number of basins are online).

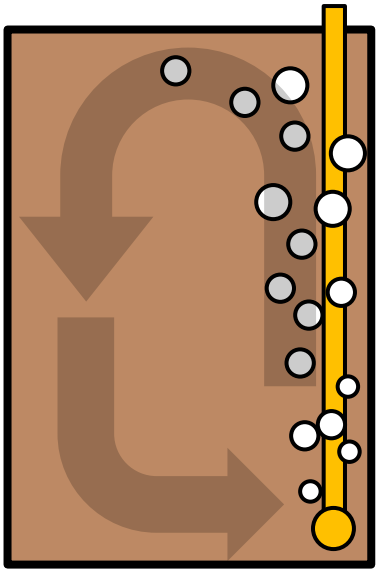


Figure 2 - Illustration of spiral mixing in aeration basins

Estimated Range of Aeration Demands

During the October 7, 2020, site visit, operations staff explained how the existing aeration system was operated and how the delivery rate of the aeration system was manually throttled on the discharge side of the blowers using butterfly valves located at each aeration basin. Despite operations staff having done everything possible to throttle the air output of the existing blowers, and reduce the amount of aeration imparted to the biological process aeration basins, the DO measured in the process basins remains much higher than what is required for almost all treatment loading scenarios.

The amperage drawn by the single blower operating was measured during our site visit. That value was then compared against the blower curve data provided by the manufacturer of the original blower equipment. The blower nameplate and the curve provided by the manufacturer confirmed that the existing blowers can deliver 1,400 SCFM at full load.

Charting the measured amperage draw of 45 amps on the blower curve revealed that the blowers were throttled down as far as they could be without sending the blowers into a 'surge' condition. It was estimated, based on the amperage draw, that the blower operating at this point was producing between 550 and 600 SCFM. Even at this throttled condition, the measured DO in the two biological process basins was more than 8.0 mg/L. The optimum range of DO is between 3.5 to 4.5 mg/L. This provides another indicator that aeration demands are much less than 600 SCFM.

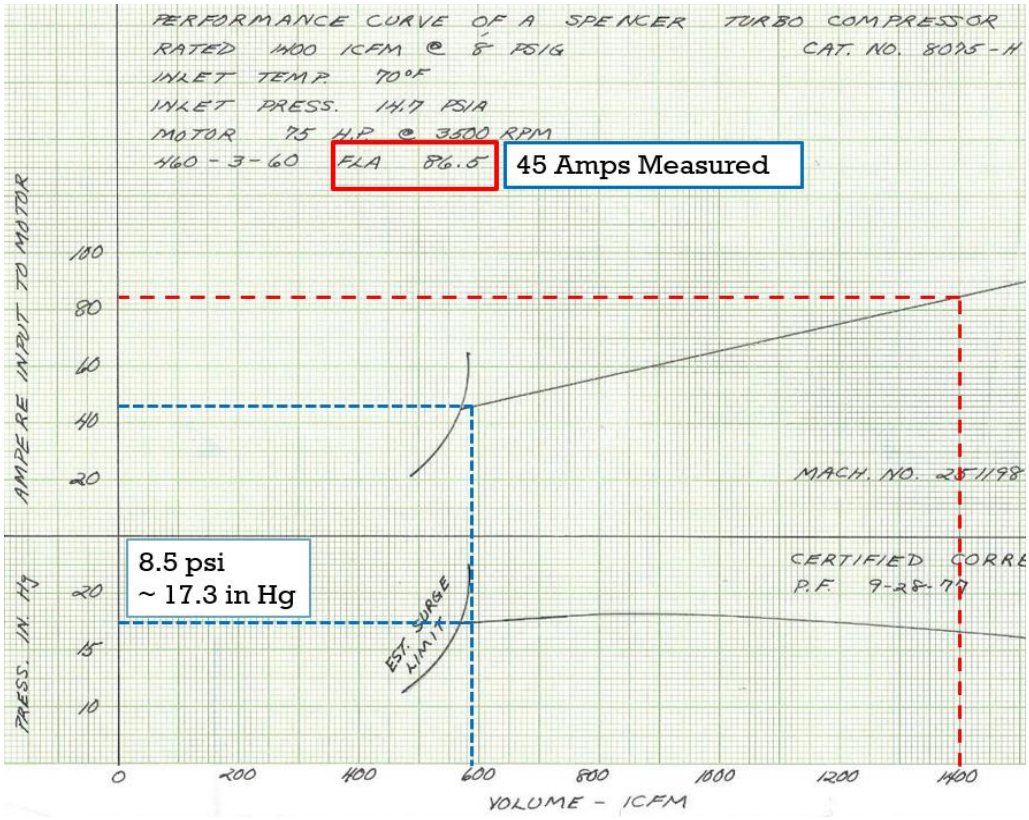


Figure 2 - Existing blower curve showing limits of operation

Based on a review of the existing aeration basins, their mixing requirements, and statements from operations staff for the current operating strategy, the air flow required is estimated to range between 161 and 645 SCFM. This range will provide the flexibility to operate with 1 and 4 basins online at any time and with an air requirement of 161 SCFM per basin, which is equivalent to approximately 5.2 SCFM per foot of basin length. However, it is recommended that a subsequent evaluation be performed to assess all future operating scenarios based on different input parameters to determine the optimal range of operation for the new blower system.

Blower Selection

For this evaluation, a blower was preliminarily selected based on capital cost and power consumption while maintaining the ability to provide the range of air delivery rates discussed above. APG Neuros was contacted, partly due to their experience with installations in Alaska, but primarily because they are a leading high-speed turbo blower manufacturer in North America. They were asked to provide preliminary information for new blower equipment and associated budgetary cost information. Their blower equipment has been recently installed at wastewater treatment facilities in both Kenai and Soldotna. Their blower equipment components are manufactured overseas, but assembled in North America, with local representation in the Seattle area. The APG Neuros blower that best represents the criteria presented herein is model NX30-C080. This blower has an operating range of approximately 150 SCFM to 650 SCFM under similar process conditions.

APG Neuros blower technology involves high-speed blowers with air bearings that accommodate rotational speeds of 20,000 to 30,000 RPM. These machines are very small in physical size, which is an attractive feature for this project. Other important features include: 1) no lubricating oil or associated maintenance, 2) contact free bearings, which results in less noise and vibration from the motor during operation, and 3) unitized package that includes the blower, variable frequency drive, and controls. A proposal from APG Neuros for the preliminarily selected blower, model NX30-C080 is provided at the end of this memorandum.

Summary of Recommended Improvements

Reconfiguration of Existing Generator Building - Given the concerns with the existing electrical classification requirements in the Main Process Building, the best option for installing new high efficiency blower equipment involves the repurposing of existing building space, which currently houses an out of service engine generator. The building footprint available is approximately 16 feet x 16 feet, which appears to be adequate for new blowers and supporting electrical equipment, as well as the required headroom for routing air intake and discharge air piping.

Photo 2 – Existing Generator Building – South Elevation

The existing concrete, steel structure, metal siding and roof, and building mechanical equipment (i.e., unit heaters, exhaust fan) appear to be in good condition. Modifications will be required to the south wall to install permanent access for removal of existing generator equipment and loading new blower equipment.

Further investigation is required to determine the current condition and remaining life of the existing metal superstructure. If capital funding allows, it may be more practical to remove the existing building envelope, reuse the existing concrete pad, and construct a new building on top of the existing foundation wall.

Improvements to Automated Control System for DO Control - The existing blower equipment has no ability to automatically manage air flow delivered to the basins in response to changes in process air demand (DO level) or the number of basins in service. Tying the operation of the blowers to the plant SCADA system would reduce overall aeration power cost by maintaining the aeration basin DO level at an operator-selected setpoint, typically between 3.5 to 4.5 mg/L. The automated system will also maintain minimum mixing delivery air flow rate based on the number of operational basins.

The aeration basins have several existing DO probes connected to the AWWU SCADA system that allow operator to monitor DO levels at various locations. These values and the status feedback from the new blowers can be used by the SCADA system to provide a speed control of the new blower equipment. Communications interconnect between the existing SCADA system and the new blower equipment shall be via Cat6 Ethernet connection utilizing the EtherNet/IP communications protocol. The blower package is typically supplied with a KEB-brand variable frequency drive (VFD), Allen-Bradley CompactLogix Programmable Logic Controller (PLC) and small A-B touch screen operator interface terminal. The blower equipment is supplied as packaged systems, so the electrical disconnect switch, operator terminal, VFD and PLC are all supplied in a single enclosure as a fully tested assembly from the manufacturer, with minimal need for on-site wiring.

Photo 3 – Failure of Ex. 8-inch PVC Piping

Replacement of Blower Discharge Piping - During the site visit, operations staff pointed out a removed section of the existing 8” PVC blower discharge piping which had recently failed. Longitudinal cracks in the PVC piping were found, and not surprising, as the piping has reached the end of its useful life.

It is recommended that the existing discharge piping be replaced as part of this project. Piping upgrades will include replacing the existing PVC with schedule 40, type 304 stainless steel to effectively delivery the high temperature air from the new blower equipment.

To reduce the initial capital cost, stainless steel piping is proposed to be installed from the new blower equipment to the 3-inch isolation valves at the top of the drop legs. The existing 3-inch PVC piping downstream

of the 3-inch isolation valves, and below the water level, will remain in service. Further investigation will be performed to confirm the existing 3-inch piping is serviceable.

Phased Implementation of New Blower Equipment – For the purposes of this evaluation, and to reduce the initial capital cost, the implementation of a phased approach is recommended for new blower equipment. This option includes installing a single 30 Hp high efficiency turbo VFD blower to operate in a permanent lead position and maintain the continued operability of the existing blower equipment as redundancy (spare) capacity. The intention would be to install all the accommodations for a future "plug and play" implementation of a second blower.

Automatic fail-over to the existing blower equipment in the event of a malfunction of the new turbo blower is not recommended due to the likelihood of the existing electrical equipment needing to be brought up to current NFPA recommended practice. It should be noted that a failover feature is not currently incorporated such that operators are required restart equipment manually.

In the event the existing blowers are needed as backup, AWWU may want to consider utilizing the 600KW standby generator to run the blowers to eliminate electrical demand charges levied by Chugach Electrical Association.

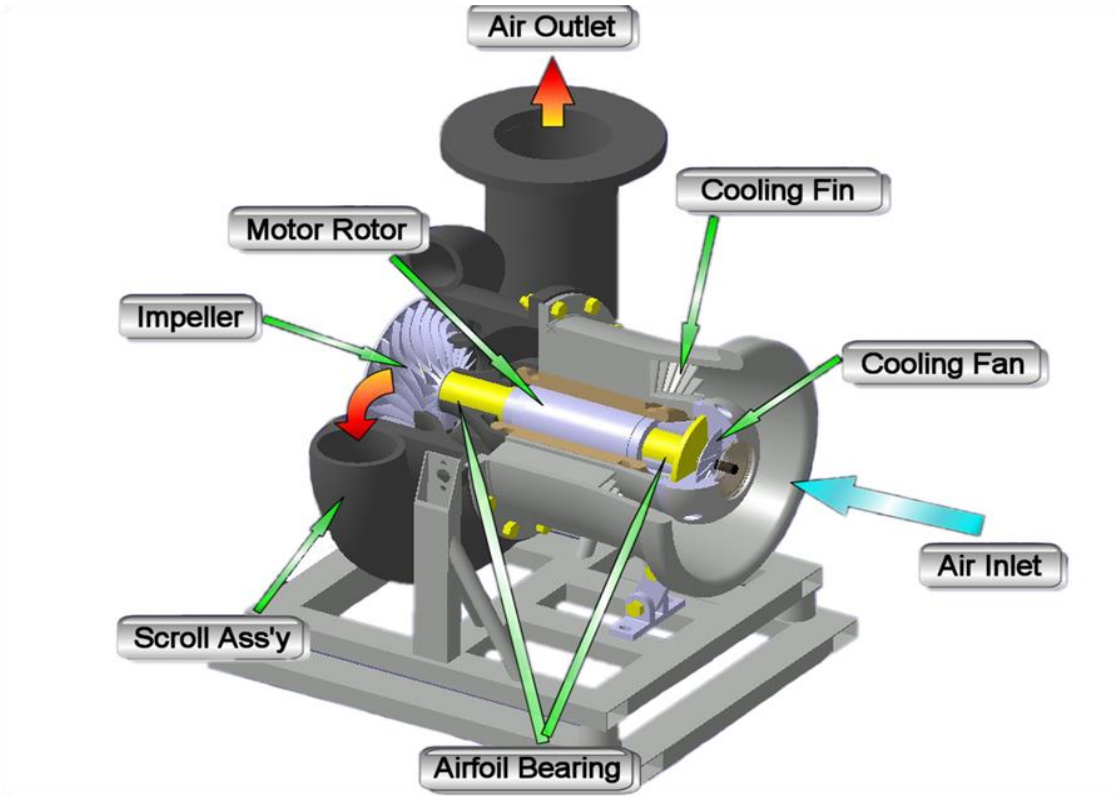
Electrical and Control System Upgrades – Recent electrical upgrades at the Facility (GWWTF Upgrades, Phase 1 Expansion, 2014) anticipated the need for equipment upgrades outside of the Main Process Building and installed a 480 volt distribution panel with sufficient spare capacity to support the new blowers. This panel, known as the Station Service Panel, is located between the generator building and the Main Process Building. It is recommended that the new blower be powered from this panel, with the generator building lighting panel (Panel P-1) remaining on the existing feeder circuit and low voltage transformer that are currently installed at this location. Lighting Panel P-1 provides for lighting, receptacles, unit heaters and other ancillary loads in the generator building.

Remote control and monitoring of the new blower equipment can be accommodated by the installation of a single Cat6 Ethernet link from the Plant Main SCADA panel located in the Main Process Building to the new blower. Programming modifications will be required to the plant SCADA system to integrate the new blower equipment and associated DO control logic into the existing plant process control system and iFix graphical displays.

APG-Neuros Turbo Blower Scope of Supply Proposal

Girdwood WWTF, AK

Prepared By APGN Inc. *dba* APG-Neuros
Sales Representative: APSCO
November 16, 2020
Proposal Reference# 11333R1



APG-Neuros Turbo Blower Core

APGN Inc.
1270 Michele-Bohec, Blainville, QC, J7C-5S4
Tel: 450-939-0799 Fax: 450 939 2115
www.apg-neuros.com

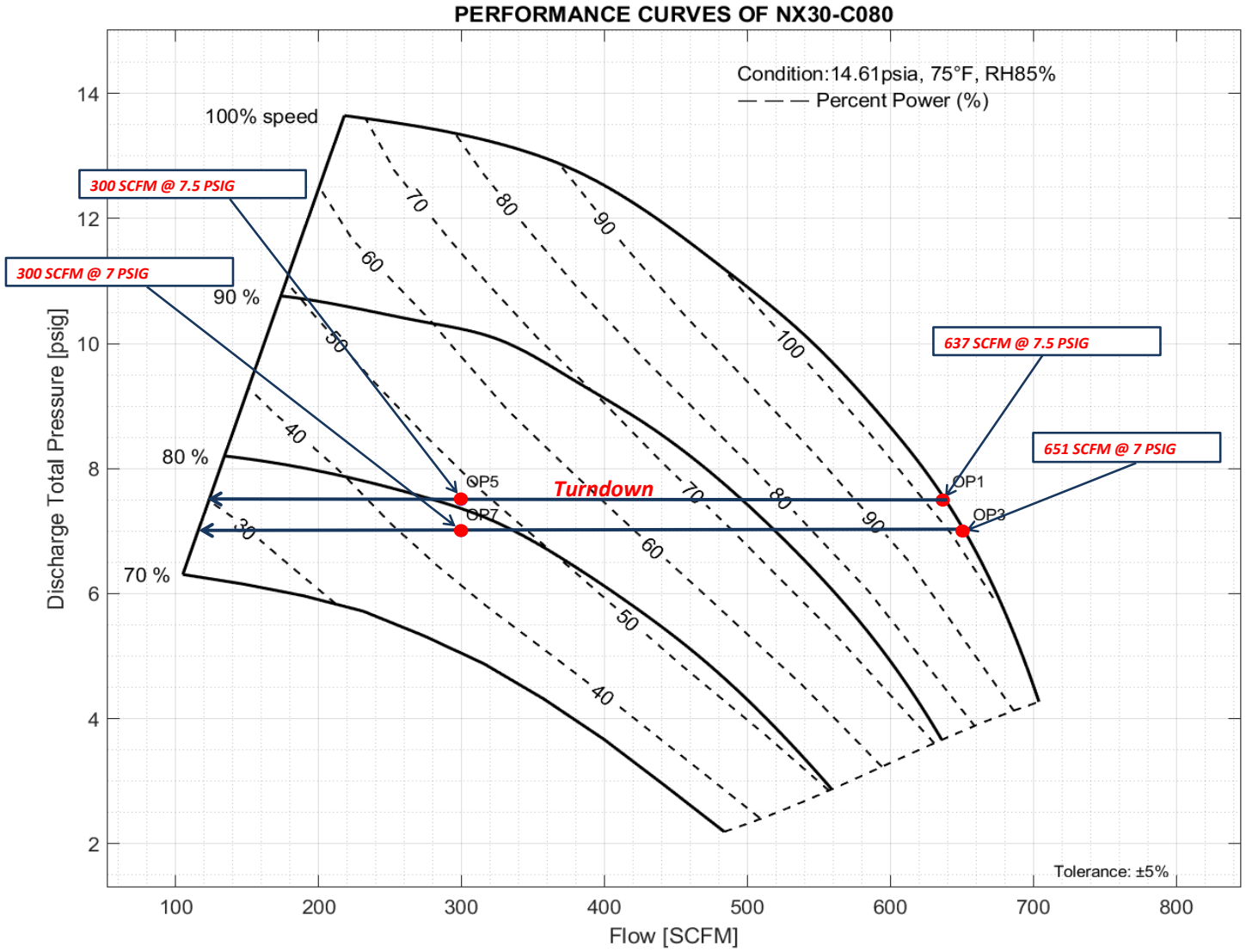
Girdwood WWTF, AK - APG- Neuros Turbo Blower - Performance Data									
Ambient Conditions									
Application	Aeration								
Blower Installation Location	Indoor								
Working Fluid	Air								
Ambient Pressure	14.61								psia
Design Conditions	DP1	DP2	DP3	DP4	DP5	DP6	DP7	DP8	
Inlet Pressure	14.61	14.61	14.61	14.61	14.61	14.61	14.61	14.61	psia
Inlet Temperature	75.0	50.0	75.0	50.0	75.0	50.0	75.0	50.0	°F
Relative Humidity	85	70	85	70	85	70	85	70	%
Duty Discharge Pressure	**7.50**	**7.50**	**7.00**	**7.00**	**7.50**	**7.50**	**7.00**	**7.00**	psig
System Flow Rate	637	662	651	676	300	300	300	300	SCFM
Flow Rate per Blower	637	662	651	676	300	300	300	300	SCFM
Blower Units on Duty	1	1	1	1	1	1	1	1	Units
Blower Units Stand By	0	0	0	0	0	0	0	0	Units
Available Blower Performance									
Model	**NX30-C080**								
Rated Motor Output Power	**30**								HP
Power @ Design Condition per Blower	**29**	**28**	**29**	**28**	**13**	**13**	**12**	**12**	**bhp**
Wire-to-Air Power @ Design Condition per Blower	**23**	**23**	**23**	**23**	**11**	**10**	**10**	**10**	**kW**
Maximum Air Flow @ Duty Discharge Pressure per Blower	638	663	652	677	638	663	652	677	SCFM
Minimum Air Flow @ Duty Discharge Pressure per Blower	124	129	116	121	124	129	116	121	SCFM
Turndown from Maximum to Minimum	80.6%	80.6%	82.2%	82.2%	80.6%	80.6%	82.2%	82.2%	%
Discharge Temperature @ Design Condition	178.5	148.6	175.6	145.9	169.5	140.7	163.9	135.3	°F
Maximum Discharge Pressure	13.64	13.64	13.64	13.64	13.64	13.64	13.64	13.64	psig
Rise-to-Surge	6.14	6.14	6.64	6.64	6.14	6.14	6.64	6.64	psig

Note:
SCFM defined at 68 Deg F,14.696 psia and 36% relative humidity
Nosie Level : +/- 2dB

APGN Inc.
1270 Michèle-Bohec, Blainville, QC, J7C-5S4
Tel: 450-939-0799 Fax: 450 939 2115
www.apg-neuros.com

Girdwood WWTF, AK - APG- Neuros Turbo Blower - Performance Data		
Dimensions and Specficiation		
Blower Length	42	Inches
Blower Width	30	Inches
Blower Height	43	Inches
Weight per Unit	848	lbs.
Blower Inlet Air Entry type	Flanged	
Inlet Flange Size (Optional, if louvered inlet does not apply)	6	Inches
Discharge Flange Size	4	Inches
Maximum Noise Level @ 3 feet	75	dBA
Input Voltage/Phase/Frequency	480/3/60	V/Phase/Hz
Full Load Amperage	32	Amps

Girdwood WWTF, AK - APG - Neuros Turbo Blower - Performance Curves



Girdwood WWTF, AK - APG - Neuros Turbo Blower - Performance Curves